# THE SURVEYOR, ENGINEER, AND ARCHITECT;

OR

LONDON MONTHLY JOURNAL OF THE PHYSICAL AND PRACTICAL SCIENCES

IN ALL THEIR DEPARTMENTS.

BY A COMMITTEE OF PRACTICAL SURVEYORS, ENGINEERS, AND ARCHITECTS, OF MUCH EXPERIENCE AND IN ACTIVE EMPLOYMENT.

ROBERT MUDIE, LITERARY CONDUCTOR.


## THE INSTITUTION OF CIVIL ENGINEERS.

WE write this august and sounding appellation with not a little of those feelings of reverential awe which come over a pious Brahmin when he pronounces the mystic OOM; and, certes, we farther agree with the Brahmin, and do not write these talismanic words until goaded on to do so by stern and absolute necessity. In fact, we consider that the Institution of Civil Engineers is, or at all events ought to be, the foremost, highest, and noblest—in the genuine philosophic sense of the term, within the four seas which girdle our island. There is of course a taboo upon majesty, and all the trappings and attendants of majesty, which sternly forbids every kind of comparison; but we hesitate not to say that, in point of sterling utility, this institution does, or should, overtop all the honourables, right honourables, and—saving their reverences—right reverends in the land. We shall not argue the matter with or concerning these parties, but shall go at once to the facts, and so going and glancing from the Lizard to Dunsby Head, we challenge the most devoted and lynx-eyed of their admirers to point us out a single work of public utility, or conducing in anywise to the wealth or comfort of the people, which has been planned and executed by a quondam member of either House of Parliament. If we would find their memorials, we must hunt in the churches, or delve in the sludgy ooze of the Annual Registers; and, after all, these are but the sayings of themselves, or of others for them; and, as for their useful deeds, their monuments are "the maws of kites," or the mighty maw of the all-devouring cormorant—Time,—to whom, in mercy to the excited and disappointed people, we often feel inclined to say, "whet thine appetite, and speed thee to the feast."

Did any of them ever plan a bridge, or a harbour, or a canal, or a railway, or is it recorded that any had ever practical science enough to improve the current of a mill stream, or drain the stagnant pollution of a forty pole puddle? We trwe not. That is not "their vocation, Hal." They are to conserve what is; and take especial care that every public improvement shall come through their wire-drawing apparatus with as much difficulty as possible; and in order, we suppose, to give future employment, that it shall be as sparing of existing nuisances as ever it can. Then, in the matter of highways,—which have been somewhat unwisely given over to the squirearchy; whereas, in justice, they ought to have been under the management of the general government long ere now, for the sake both of cheapness and accommodation. The squires have made the several lines wriggle across the country like eels in the mud—now a flexure to the right to avoid somebody's park or pheasant brake, and anon, another to the left, in order to touch at a favourite ale-house, which yields somebody a large yearly rent. It is, in short, nothing but twisting to the right, twisting to the left, toiling up hill, and tottering down, in continual succession; so that, if the gravest man in England undertakes a moderately long journey upon these roads, he must, nil he will he, "jump Jim Crow" before he gets to the end of it. Truly, as the late Sir Robert Calder once said of a certain untoward affair at sea, "the wise man may laugh them to scorn, and the fool say in his heart, 'what a kettle of fish is here!'" *Sic itur*, certainly; but, alas! alas! it is not *ad astra*,—it is "the clean contrary way."

Let us now contrast the actual and permanent doings of the engineer, with the sayings and somethings of the parties to whom we have alluded. If we quarter the whole land, we not only find durable memorials of the engineer in every county, but we are forced to the conclusion that he is the grand stimulater to every kind of improvement; and that, without the aid of his labours, Britain would at this moment have been an alternation of tangled swamps and dreary wastes, inhabited by a few miserable savages. The man who dwells apart, as all men, or at least all families, must do in such a country, may kill wild animals, or cultivate a few coarse plants; but we must have the engineer before there can be any thing worthy the name of society—the only state in which, "as iron sharpens iron," so does each man call forth the energies of his fellow.

The beginnings of engineering are, no doubt, like those of all things, small and simple; but they are the most important, because, if we have them, we may come to the others, whereas without them we can do nothing. The path trodden out as a footway or a bridle-road, the stepping stones in the ford, or the tree laid across the gorge, are the beginnings; and, rude though they be, they enable mankind to visit, and by so doing, instruct each other. In all matters, the first step,—the step from 0 to the smallest fraction,—is immeasurably greater than any which can be taken afterwards; and this is just as true in engineering as in any thing else.

Let us, for the sake of illustration, suppose the rest of society to be just as it is now, in as far as its own exertions can accommodate itself; and let us suppose that there never had been any engineers, or that every iota of their doings were obliterated. We know that this supposition involves a contradiction, inasmuch as no people could arrive at the state in which those of Britain now are without skilful, efficient, and long protracted, labour of engineers. But we are merely putting a case in illustration, not seeking to establish one by argument, and so we may with perfect fairness make the supposition. Suppose, then, all engineers, and all who in anywise contribute to the engineering profession, to have got themselves gone, and to have taken with them the whole of the roads, bridges, boats, and other means of transit by land or water,—for the whole of these fall directly or indirectly within the province of the engineering profession, when taken to the full extent that the name will bear:—suppose this; and suppose farther that the honourable member for the county of Caithness is in that county, and requires to attend in his place in the House upon a certain day of a certain month, the question arises, what time will, in that absence of engineering which we have supposed, be required for the messenger on foot to carry the summons to him; and what time will he, wallet on shoulder and horsed on brogues, require to wend his way from the cliffy shores of the Deucaledonian sea, to Palace Yard on the sludgy banks of the softly-flowing Thames. We sincerely wish that we saw the entire Institution of Civil Engineers, with the surveyors to boot, fagging successfully at the solution of this problem; because, if they could bring it to a clear and demonstrable issue, we should feel perfectly sure that we should never have one faulty estimate of a public work for fifty years to come. It would be vain for us, single handed, and with our feeble pretensions to matters of the kind, to attempt any thing like a solution; but we invite the reader, if it shall so please him, to spread before him one of the largest and best maps of the island, in which the rivers and mountains are faithfully represented, and let him allow both messenger and member to be capital jumpers, and good at setting the staff to wade breast-deep through a brawling stream; and then let him trace the line along which each would have to pass, guess at the average number of hours per day, and say whether both journeys, if practicable at all, could be performed in less time than three or four years. Nor is it the mere length only of the summit level, which out-twines the worst engineered roads in the kingdom, for there would be other and far more serious difficulties. In the first place, how would they find the way; for the pocket compass, and all other contrivances for determining bearings, are engineering instruments, and would of course be taken away by the engineers; and every one who has travelled much among pathless mountains and twining streams, knows full well that the variation of the compass in the head is too erratic for being controlled by the wits of one member of parliament, or even by a statute passed by the unanimous wisdom of both Houses, with not a member absent. In the second place, there would be a plenteous lack of the sinews of war; and they

would be compelled to come within that category in which Butler places the heroes of chivalrous romance:

> "For as, when through deserts vast
> And regions desolate they passed,
> Where belly-timber, above ground,
> Or under, is not to be found,
> Unless they grazed, there's not one word
> Of their provision on record:"

nay, they would be worse than this; for there are miles and miles where they could not even graze, but would have to be contented with biting at the stunted heath, the sludgy peat, or the flinty rock; and though these might do for a knight errant for an hour or two, a knight of the shire would find them very short commons for successive moons and moons of Alpine pilgrimage. In the third place—and to those whose stomach is not in an especial manner their idol, it is the ugliest yarn in the web of fate—there would be two winters, if not three, upon this fearful march, and they would come in their utmost fury, and their duration would be long—far longer than in the present state of the country; for, though those who have weak eyes and heavy craniums, so that they keep poring on that mud in which their greedy hands are ever and anon poking, cannot see it, the labours of the engineer have greatly ameliorated the climate of Britain, and, if properly employed, he would do it much more. Supposing, and that would be about the right supposition, that the winter burst upon them when threading the summit of the Grampians; the wind careering onward at some 120 miles an hour, and thundering upon every jutting cliff and mountain peak, in sounds more terrific than if all the Titans which fabulist ever fancied were smashing the earth with their hammers of adamant; and the snow-drift reeling and whirling, and whelming, and burying, and darkening mid-day to the blackest night, and mantling the dells and gullies to hundreds of feet. Why how could even an M. P. keep the life, upon the lonely hill, without a stone for shelter, or a voice to bid him God-speed; the fiercest gust of St. Stephen's, even in the high-tide swell of its tornado days, would be the soft south wind sighing over a bed of violets, compared with the mighty march of winter upon those fearful mountains; and the terrified M. P. would, in the bitterness of his soul, exclaim, "Oh! for a lodge in *this* vast wilderness;" but he would not get it.

After this very feeble and imperfect delineation of what would be met with on the Grampians, we shall enter into no particulars as to the border mountains, or the moors of Derby and Stafford, with each of which he might have to grapple in another winter. But these would let him down gradually; and if ever he should arrive at the metropolis, the thickest fog of charcoal and sal ammoniac that ever brooded over that city would "lap him in Elysium."

Such, in plain, simple, and unvarnished language, would be the state of things, if there were, and had been, no engineers; and now, let us see what they have done for this single, but of course most valuable, member of society. In not more than three days the summons reaches him by the post; and on the fourth day he is ready for his journey. He may glide in coach at some ten miles an hour, trundle on railway, for great part of the distance, at more than double that velocity; or, if he more affects the waters, he may house himself in the steam-ship all the way, and take his ease as though he were at his inn. Perhaps indeed the last is the most eligible means of transit; for old Neptune may be propitious, and he may get cleansed of all the rejectamenta of pickled herrings and pounded stockfish, and so be enabled to enjoy the refection of the speaker's breakfast, or the long drawn out gourmandize of his party, with more than an ordinary landsman's zest.

Now we would ask, or rather we would beg the northern M. P. to ask himself, to whom is he indebted for those contrivances and accommodations, which have given him the speed of a roebuck on land, and of a skate on the water; and we answer with pride and cheerfulness, and he may answer with what feelings he may,—to the engineer, and the engineer alone. It is the engineer who has brought, as it were, not merely the ends of an island, but the ends of the earth, into close juxta-position with each other, without diminishing for useful purposes a single inch of the intermediate space; and it is he who has yoked the winds and the waves, the fire and the flood, to the chariot-wheel of human accommodation, and made them do more for the promotion of British industry, British intelligence, and British comfort, than if all the other nations of the earth were bond slaves supporting themselves and toiling for us.

In this illustration we have taken an individual case, and that a very simple one,—one in which we have supposed the party to derive no advantage from the facilities afforded by the labours of the engineer, farther than great personal convenience and a most extraordinary saving of time. In the particular case which we have chosen, these may, in great part at least, be considered as merely negative advantages. But when we consider the active and productive part of the community, who compose the great body of the population, and reflect on the almost endless number of ways in which engineering, in one or other of its multifarious departments, has benefitted that, the importance of the profession rises up as if by magic, and overtowers, like a giant of the fairest proportions, and the most benign aspect, all else in the land. If we read the book of our benefits aright, we must see and confess, and that with pride and thankfulness, that we are an engineer-elevated people; and that, but for engineering, instead of standing as we do at the head of the nations, we must have ranked very low in the scale.

Go where we may, examine what we will, we invariably can trace the hand of the engineer in every thing that partakes of the nature of improvement, or furnishes any accommodation or comfort beyond what our country would have yielded in the savage and uncultivated state. No doubt there are many named professions and trades between the engineer who gives the impulse and makes the beginning, and the users who reap the advantages; and of these intermediate workers not a few are ignorant of the nature and value of the functions of the engineer. But still, the number of parties that there may be between the contrivance and the completion, and the ignorance which they, or any number of them, may be in with regard to the importance of the first step, as compared with any subsequent one, or of the relations of the different steps to each other, do not, and cannot, invalidate the general truth.

As it is by engineering, in all its various branches, original and subordinate, that we have attained the superiority over other nations; so it is by the same means, and the same means only, that we can keep it. Since the general peace was established, several of the continental nations have been not only following, but actually nearing us; and, if we do not bestir ourselves, there is every probability that they will soon get in advance of us, and the moment that they do this, our decline is begun. Once let them equal us in engineering skill, and they will soon get the better of us in execution. For the execution of great works they have facilities greater than any that we possess; and thus they can execute such works more cheaply than we—in some instances they have completed the work for not more than what an act of parliament permitting it to be begun would cost in this country, especially if there were a sturdy opposition; and be it remembered, that such oppositions can be got up and maintained upon the most frivolous grounds, by those harpies which infest and pollute the lobbies of the Commons' committee rooms. But not only can great public or national works be more cheaply executed on the continent than in Britain; for the same holds good in the case of works and establishments for private parties. This arises from our enormous taxation, which, with the exception of those countries that are plundered at will by their despots, is heavier than ever was levied on any other people on the face of the earth. As between ourselves, this is equalized, and so we do not feel it; and hitherto our superiority, resulting chiefly from our engineering, has prevented us from feeling it much in our intercourse with foreigners. If, however, these foreigners should—and they will, if we do not bestir ourselves—rival us in engineering skill, and its application to the constructing and working of all kinds of machinery, then we shall feel the full weight of the millstone which is about our necks, and it will sink us as lead in the scale of the nations.

It is true that we possess some very important physical advantages. The sea, for instance, is more available both for the purposes of peace and of war to us than to any other people. Our rivers, too, are all our own, so that we can turn them to any useful purpose that we please without consulting any other power. In this last case there are, however, some counteracting circumstances; for the different proprietors through whose estates a river flows may offer as fatal opposition to its general improvement as though they were as many distinct monarchs. Again, our country abounds in those materials which are essential to engineering, and to the arts connected with or arising out of it. On the north-east coast, on the Bristol Channel, on the Mersey, on the Dee, on the coast of Cum-

berland, and on the estuaries of the Forth and the Clyde, we have ample supplies of coal proximate to the sea, and therefore admitting of being carried to every point of our shores at the least possible expense; and in the centre of England, near to where the rivers rise and flow toward the opposite seas, we have also abundant supplies, which can be sent by water-carriage to all the surrounding districts.

While we possess our engineering superiority, there is no doubt that these are great advantages, and probably the origin of that superiority may have been, in a great measure, owing to them. But the advances which Belgium, Prussia, parts of Austria, and some other countries are, even now, making upon us, show that these physical advantages are not of themselves sufficient for enabling us to keep that rank which we have long held among the nations; and, as has been already hinted, the relative burden which is upon our industry, in its every branch, and of which we cannot by possibility get rid, will sink us down from the moment that nations less burdened shall raise themselves to the same level with us.

Should this come — and the present aspect of affairs strongly portends its coming — it would be incurable, and our national degradation would be certain and rapid in its course. In all cases where the evil, when it does come, admits of no remedy, the only plan which can be pursued, and the plan which every man of sense will naturally pursue is, to bend the whole of his energies to the discovery of means of prevention, and bring these into immediate and vigorous operation. For the sake of clearness, we shall again enunciate the evil to be dreaded, before we inquire into the means of prevention, or the mode of their application. Britain has long taken the lead among the nations; and she has been enabled to do this in consequence of her superiority in engineering, and in the arts connected with it, or growing out of it. Since the general peace, various other nations are gaining upon Britain in engineering and the collateral arts; and such are their political facilities, and the consequent rate of their advances, that there is every chance that Britain shall be outrun and distanced by them, and this at the end of no very long period of time. Should this occur, the irremovable burdens upon Britain are such that she has no alternative but to go down in the scale, and such is the weight of the burden upon her that, if she once begins to sink, she will sink rapidly and irretrievably.

This is the simple statement of the question, the most important perhaps that ever was mooted; and it immediately suggests the inquiry, what shall be done to prevent so direful a national calamity? Some may think of the great strength, the superior equipment, and the admirable science and discipline, of our fleets and armies; and we are very ready to add the small weight of our testimony to the value of these, as being the best, *with the engineering superiority of the country*, that ever existed. But it must be borne in mind that the fleets and armies did not produce, neither will they maintain, the country, for the country produces and maintains them, and, if it shall sink, they also must sink, and that more deeply in proportion. If armaments, whether by sea or by land, are to be loyal, honourable, and effective, and win the heart by their conduct while they beat down opposition with the sword, they must be well and regularly paid and supported by that country to which they belong; for if you once make a mercenary of a soldier, you destroy the first principle of his moral courage, even though you pay him ever so largely and regularly as the hireling of a strange people. Therefore we can in no wise look upon the navy and the army as calculated in the least to avert the national degradation and ruin of which the signs are apparent; though both would certainly tend to deepen the misery if it came.

As little can we look to the wisdom of the legislature. That seems over-worked with its law-making and law-mending functions; and therefore, whatever ability it might have, it really has no time for giving a fresh impulse to the inventive and working energies of the people. And then,— for we must tell the truth — though it could spare the time, it has neither the ability nor the knowledge of how ability is to be applied to the case. The case is a practical one, in which all the doing must be done by every man for himself; and what is specially wanted is some superior lamp of engineering and practical science in the land, at which the people may illuminate their understandings, and enkindle their energies, without feeling that it is a borrowed light.

After casting about to find the subject by which this regenerating light should be enkindled, we are brought to THE INSTITUTION OF CIVIL ENGINEERS as the appropriate and only one; though here our observations leave us to fear that we have but "a cold coal to blow at." It *is* a coal, however, and smart friction may warm it. We know that there is plenty of talent in the institution; because the members show it when they are actually employed. But, *quoad* the institution, it is individual talent which is never generalized; and which therefore does not promote any one of what ought to be the legitimate objects of such an establishment. When foreigners think of England as the foremost engineering country in the world, and hear of the "Institution of Civil Engineers" of England, seated in one of the most fashionable streets of the metropolis, they are apt to fancy that it is one beam of engineering light, which illuminates and warms, and inspires, to the four corners of the empire, while the "blink" thereof is seen and hailed with joy in distant lands. But, alas! like many, indeed most, subjects of over-towering height, it stands, *caput inter nebulæ condit*, and never shines at all without the walls of its own apartment, and even there it only glimmers.

Of this, however, more anon; for we must inquire what such an institution ought to do, before we tell what it really does. Now, in the first place, it is the duty of an institution of civil engineers to be perfectly acquainted with, and to keep a sharp eye upon, all engineering projects throughout the kingdom; and if a foolish or unnecessary work is proposed, an imperfect survey made, or a work ill planned, or badly executed or managed, it is the duty of such an institution to lift its voice in thunder, and point the finger of public indignation at the guilty. If the institution had rightly exercised this power, which clearly belongs to it,—otherwise it has no business to exist,— we should not have had so much disgraceful work in constructing the railways, nor would there be so many fearful accidents in the using of them. Parliamentary committees, commissioners, and so forth, are mentioned as remedial for those evils; but any one who understands the case would as soon think of referring it to a committee of Egyptian mummies. It is the business of engineers, and of engineers only,—not as individuals —for wicked wits might say that would be setting a "somebody to catch a somebody,"— but in their cumulate weight as an institution; because by this means, and by this means alone, the evil would be prevented, without jarring the chord of an individual feeling. They must excuse us if we tell them that we hold them, and that the public will hold them, not as individuals, but as an institution, as being *particeps criminis* in one and all of those blunders and disasters, because they, and they alone, could have interposed and prevented them. And we will tell them farther, that, by neglecting these things they have lowered their institution, and the whole engineering arts in England, not in the eyes of the British people only, but in those of all the world; and thus they have done much to speed that national catastrophe, the onus of preventing which lies chiefly upon them.

In the second place, the institution, as an institution, seeking to promote the welfare of the country, and not as individuals on the hunt for jobs, should make itself thoroughly acquainted with the physical resources of every inch of the United Kingdom; and of the nature, extent, and practicability, of such works as might render those resources more valuable in their own locality, and to the country generally. It would not be difficult for such a body as the institution to collect this information, and to augment and improve it from time to time, and by this means they would render themselves capable of performing certain public duties of great importance, which hitherto have either not been done at all, or done in so imperfect and bungling a manner that they had better be let alone. We may mention one or two of these: this knowledge, known to exist, and ready to be applied, by so learned and influential a body as the Institution of Civil Engineers, would make the most bronze-visaged and leaden-brained projector upon earth do his best to think twice before he attempted to foist his ill-shaped absurdity upon the public, whether to occupy the place of a better work, or the place where no public work ought to be. Here, again, we might appeal to the subject of the railways; but we are sick of such appeals, and we bid the sceptic look generally at all the public works in the country, and say whether any one of them is exactly what it would have been if the projectors and planners had had the eyes of such an institution as that of the civil engineers ought to be vigilantly open upon

them. Another function: The institution thus possessed of knowledge, must be of the utmost value to the legislature. The members of that cannot possibly know much about engineering, and though they knew more, they have little leisure in which to bring their knowledge to bear. Hence, whenever a project for a public work came before them, it would be of the greatest value, both to them and to the public, to have the power of remitting, it *in limine*, to a large body of engineers, thoroughly informed upon the subject, and altogether free from prejudice.

In the third place, this institution ought to make itself intimately acquainted with all engineering works, projects, and speculations; and it ought by every means to bring the whole volume of its engineering knowledge to bear upon and stimulate an engineering tone among the people generally. This is, in fact, the grand desideratum, and the one the supply of which would inspire Britain with new vigour, and render it impossible for any nation whatever to outrun her in the race of improvement. As we conceive this to be the greatest, so we believe it to be the most stringent duty upon the institution, and the one for the neglect of which they are most culpable. They, or some of them, may plead that there is no fee for the doing of this, and no per centage upon the resulting improvements. Now, we despise such a plea as unworthy, and spurn it from us as unjust. Every engineer who rises to any degree of eminence owes to his country a debt of gratitude which his utmost exertions can never discharge. An engineer cannot buy promotion with money, like an ensign in a dandy regiment; and although we have heard it whispered that in times long gone by, "a cannie word weel spoken, and in gude time," has procured the speaker a job for which he had not the shadow of a claim on the score of merit, yet we are willing to suppose that such practices have ceased for these many years, and that engineers of the present day stand upon their merits, and their merits alone. Such being the case, they are indebted to the discernment and liberality of the public for whatever share of promotion, praise, and pecuniary reward they or their fathers may have gotten. Without this they might have remained "hewers of wood and drawers of water," for the whole term of their mortal lives; and if this does not teach them gratitude, we know not what could have that effect.

In the fourth place, the institution ought, by all means in their power, to endeavour to throw or kindle a halo around the engineering sciences and arts, and every thing connected with them, and especially with their own establishment as the centre and focus in the British islands. Their meetings ought to be extended over a longer period of the year; because, to meet just about the time when Parliament meets is apt to give those that know no better a false impression, that they are attracted to Westminster only by the scent of parliamentary jobs—which everybody that knows any thing about the matter knows not to be the case. The meetings ought to assume a more elevated tone, and subjects of greater and more general importance should be brought forward at them. They ought to be made the élite of all the scientific meetings in London, just because engineering is the noblest and most generally and substantially useful of all the applications of science. Their transactions ought to be an instructive classic, sought for, and delighted in, by all nations, just as the transactions of the Royal Society of London were when that society was in the freshness and vigour of its early prime. Old Time has driven his ploughshare not a little over that once splendid institution; and this was perhaps to be expected in a society devoted to science generally, and having no one specific object growing in extent and usefulness. But the Institution of Civil Engineers not only has such an object, but it has the very best one that any society can possess; and therefore it were melancholy even to imagine that it should fall into decrepitude before that time which, in ordinary human reckoning, is called "the years of discretion!" It is true that we have not read all that the society has published; but we have read a little, and, whether owing to our own obtuseness or not, truth compels us to say that our desire of reading diminished faster than the quantity we read increased. We are far from saying that, like the enchanted volume in the romance, these publications would strike any one dead asleep who simply opened them, but we should shun them if in a sleepy humour, and recommend others to do likewise. Farther, when the world is deprived of an eminent engineer, the hall of the institution should be made to shiver to his éloge, given in strains of the most glowing yet most classical eloquence; and all the great works which he has done should be portrayed in the most faithful and most fascinating manner, so that the young engineers present may catch a shred of his inspiring mantle, and firmly determine to imitate his career.

We might extend this enumeration to a much greater length; but we feel that we have exhibited *quant. suf.*, and such also we suppose will be the feelings of our readers. We shall therefore conclude with a short glance at what usually occurred at such meetings as we have seen; for we are quite in ignorance as to the influence of the Institution, as such, in any other quarter.

Of the first three points that we have enumerated, we do not believe that the Institution ever gave even one the slightest consideration; and, with regard to the fourth one, there may be some resemblance of the dry bones, but the spirit is gone. In the matter of the éloges they put one forcibly in mind of the card player whom Swift describes as hearing of the death of that first and bitterest of all satirists:—

"The Dean is dead!—Pray what is trumps?"

showing that the party was much more intent upon "winning the trick" than any thing connected with the memory and patriotic services of the illustrious dead. Where is the éloge on David Logan, or that on Alexander Nimmo? the first, one of the best practical engineers, and the second the most scientific, that the kingdom ever produced. The hollow vacuities of the hall and the Transactions merely echo the word "where." And Thomas Telford—the manly, the liberal, the immortal Telford—the father, the best benefactor of ——but there is a drop of gall in the pen, and we must pause and shake it out. * * * Perhaps we might venture to ask this institution why M. Arago was the first to draw up a decent account of James Watt.

Now for the meetings. They are pleasant enough in their way, but want all the more important elements which we could wish them to possess. The members assemble in the hall; and, after the routine business, some one reads a paper perhaps, but it is not often on a very useful subject, or replete with very valuable matter. Then comes the "lion" of the evening: some scheming inventor is called on to advance towards a pretty little model which stands on the table before the president. It may be a mouse trap, a cork screw, or a jack-in-the-box, with some slight alteration "for better or for worse;" but if it is a very pretty model it will do. The exhibitor says his something; the president nods applause, and invites remark; and forth fare the connoisseurs to the judgment. Their criticisms are carried on with that bonhommie which characterises all the proceedings of the Institution; but they are sometimes quite as ludicrous as instructive. This is especially the case when a certain member on the *côte gauche* advances to the table, and essays to convert his whole corpus into an organ of speech. He places his palms on the table, brings his facial line to a parallel with them and at a very little distance, and contrives so to bend his arms that they do not seem one-third of their usual length. Then he elevates his *sacral aspect*, and wriggles it to and fro, like the farther end of a truncated snake, working his legs and feet alternately back and fore all the while. By all the world he is like a kangûrû, struggling to get out of the deep trough of an Australian water course, or like a speaking pair of bellows. Yet, such is the power of science, not a risible muscle stirs; the meeting is closed; tea, coffee, and pleasant chat enjoyed; then, home to supper, and to Morpheus; and, we suppose,

"Through the ivory gate the vision flies."

---

## ARCHITECTURAL ANOMALIES.

THE article bearing the above rigmarolish title, in the POLYTECHNIC JOURNAL for November, which opens with an impertinent commonplace flourish about architecture being the parent—yet may it not with equal propriety be called the offspring—of civilization, consists chiefly of miscellaneous rambling strictures upon several of our buildings in London; and, although we do not meet with much that is either very new or profound in it; there are one or two opinions thrown out which induce us to take up our pen for the purpose of commenting upon them.

"The palace of Buckingham House," says the writer, "is, perhaps,

one of the greatest enormities of modern architecture. The failure has arisen in the attempt to give an air of grandeur to an edifice composed of a multiplicity of minute divisions; separate this building into sections, and the beauty of any one can hardly be denied." Now we conceive that it would have been more correct to say that the grandeur which should have been aimed at—but of which the architect seems to have little idea—has, among other causes, been greatly impaired by the design being cut up into a multiplicity of minute divisions. The fault lay not in "attempting to give grandeur"—most assuredly not—that quality being the one of all others to be expressly aimed at in such a structure—but in not understanding how to produce it. Probably, this may have been the writer's meaning; but, if so, he has expressed it in such manner that very few will detect it. We must take the liberty, also, of dissenting from his last remark, for we certainly see not the beauty which he seems to claim for the separate portions of the composition—though he has not cared to point out wherein their merit in that respect consists; and may therefore, without any great injustice, conclude that he was rather puzzled to do so; else, hardly would he have forborne to display his critical skill in detecting beauties imperceptible to other eyes. In the "Public Edifices of London," that piece of architecture has been rather minutely scanned by another critic; consequently he would have stood sufficiently excused for controverting, or attempting to controvert, what is there urged against particular divisions of the design, as well as the whole. Taking him, however, at his word, we ask him what beauty he sees in the centre portico, where, by the columns being placed in pairs, an octastyle is reduced to a tetrastyle, as regards the number of intercolumns, viz., three instead of seven? Or, does he perceive any beauty in the meagre tetrastyle porticoes at the ends of the wings, or in a diminutive Grecian Doric order, with a mere blank surface instead of Doric architrave and frieze in its entablature, and that, too, in a structure where greater instead of less enrichment than usual would have been appropriate? We might easily continue our queries to a considerable length, but we forbear, as those we have already put will serve to show that, even when examined separately, the individual parts are not a whit more happily treated than the ensemble.

Speaking immediately afterwards of the National Gallery, the writer assures us that "the architecture is everywhere correct, nor is there any attempt to introduce novelties of style in opposition to the models of antiquity!" What then, we ask, are the two little turrets and the dome? are not they novelties—more especially the dome, which, ugly and barbarous enough in its general form, is rendered still more so by the arched windows in its tambour, although the arch is most carefully avoided everywhere else, even in the wide openings forming the thoroughfare passages, where arches would have had propriety to excuse them?

Among the notices of churches occurs the following singular bit of criticism: "A stranger architectural *melange* than the church in Langham Place, perhaps with the exception of that of St. Pancras, can hardly be pointed out within the boundaries of the capital. The unadorned body of the edifice is concealed by neighbouring buildings, and therefore does not rest as its contemporary does, in a variosity (!) of Etruscan, Egyptian, Greek, or Roman costume." What may be the meaning of this last most oddly-worded sentence, we know not, neither, perhaps, could its writer explain. Our object in quoting it is to show what exceedingly summary judgment he passes upon a structure which, in regard to style and detail, is more perfectly Hellenic than any other in the metropolis; for, except that censure *en masse*, and introduced only as an incidental remark, he bestows not a word farther on St. Pancras' Church. It is merely stigmatized off hand as "a strange architectural melange;" therefore, as he has not adverted to that circumstance, we may, without great uncharitableness, presume that the critic is not aware that, with exception of the tower, the exterior of the building is little more than a professed copy of the Triple Temple, on the Acropolis, at Athens, with the difference that it is more regular in plan, and so far less of a *melange* than the original; which last we may observe, is our especial favourite among the remains of Grecian architecture, if only because it affords a most valuable lesson; proving that picturesque contrasts and combinations are not incompatible with the graces of a pure Grecian style. We only wish that antiquity had furnished us with a few more such *melanges* instead of the wearisome monotonousness of its thousand and one temples scarcely distinguishable the one from the other in their forms and plans. Our opinion, we are well aware, is not that of every one, for the King's College Professor censures the edifice on the Acropolis, on account of its irregularity. Were we, however, afraid of expressing our admiration without due license for it, we could shelter it under that of Thomas Telford, no very mean authority, who, in the treatise on Civil Architecture in "Brewster's Encyclopædia," says that its "irregularity of height and shape produces a fine effect; and, we think that if any one looks at the beautiful perspective restoration of the structure as shown in one of the plates in Inwood's Erechtheion, he will acknowledge it to be by far the most picturesque and captivating composition that classical architecture affords. Still, as regards St. Pancras' Church, we wish that the architect could have so far deviated from the original as to place the two porches with caryatides at the west end, making them wings flanking the portico, and thereby not only producing a rich extended façade, but screening the side elevations, where the windows (the lower ones exceedingly insignificant) interfere sadly with classical character, and detract considerably from the aggregate impression. How far we are here correct is what any one who can draw can easily ascertain for himself, by sketching a *refacciamento* of the design according to our suggestions.

Were we to indulge in our comments at this rate, they would exceed in bulk the article which serves as our text: we will not, therefore, stop to reply to what the critic alleges against the steeple of Langham Place Church, farther than to remark that it is an idea, of which, had it been properly studied, a good deal might have been made: even as it is, it is some degrees better than the same kind of portico and tower to Sir R. Smirke's Church in Wyndham Place; and although he does not care to say so, we must take for granted the writer is not a whit better satisfied with any of Wren's steeples, they being indisputably "strange medleys of architectural variety." We accordingly pass on to two "porticoes in which great chasteness and beauty are displayed;" and, as the writer did not think it worth while to bestow a syllable upon that of St. Pancras' Church, not even so much as to pass any compliment upon its exquisitely beautiful doors, our readers will be curious to learn, though we are sure they would never guess, which are the two admirable porticoes that it pleases our fastidious critic to extol. One of them, no doubt, it will be thought must be that of the London University: not so, for that building is not even mentioned at all by him. Therefore, not to tantalize our readers or keep them longer in suspense, we will let them into the secret at once, by saying that they are no other than those of the Haymarket Theatre, and the English Opera House!! It is really enough to take away one's breath! To think that such a piece of vulgar, tawdry, slatternly design as the portico in the Haymarket, with its miserable shelf of a cornice, and crammed within with the most ordinary doors and windows, should be held up as a pattern of great chasteness and beauty! Neither is the other example very much better; except it be that there are only three doors within it, and no windows, but then the doors themselves are much fitter for a stable or coach-house than for a portico with Corinthian columns. Really, if such is the criticism, and such the opinions, served up to the public in the periodicals of the day, for the purpose of enlightening them in regard to architectural taste, it were better that they should be left entirely in the dark. Who the writer of such stuff may be, we know not, but most evidently it is not the author of the article, Portico, in the "Penny Cyclopædia," for there the portico of the Haymarket Theatre is justly held up as an example that ought to be especially shunned.

After such sample of his criticism and taste, the writer's compliments are quite valueless; therefore, Mr. Barry will not feel particularly elated at finding the Reform Club House dismissed with the remark that it is "a noble building," and that of "its three fronts, the *whole are* different." The last is surely a most awkward and blundering remark, for it would lead any one who had not seen the edifice itself, to imagine that they differ materially as to design, whereas, the reverse is notably the case, all the three façades being, with some slight variations, the same in design, and perfectly alike in character. Well, if the devil sends cooks, he most certainly seems to remit us critics also.

## GIOCONDO ALBERTOLLI.

Of this eminent architect, who died at Milan, in November last, in his 98th year, having been born July 24th, 1742, the following particulars will, we conceive, prove acceptable, as a contribution towards a branch of biography which is for the most part very much neglected in this country, even in works professing to notice artists of all classes. Cagnola, for instance, who died a few years ago, was hardly mentioned at the time in any English journal; or, if mentioned, was so in only a brief paragraph. Our best biographical dictionaries, too, have hitherto been exceedingly defective in regard to names of architects, particularly those of the last two hundred years.

The subject of this necrological article was born at Bedano, and first sent to school at Aosta, where he remained, however, only a single year, after which he was kept at home until the age of eleven, when, in compliance with his decided inclination for drawing, his father placed him with an artist at Parma. In that city he had also the opportunity of attending the lessons given by the various professors at the Academy of Fine Arts, then in high repute; nor did he fail to profit by them, especially by the instructions he derived from Peroni. After ten years there devoted to study, he began to obtain several commissions in his professional occupation as an architect; and in 1770 had an opportunity of displaying his talent in decorating with stuccoes, &c., a villa near Florence, belonging to the Grand-Duke (afterwards Leopold II.), to whose entire satisfaction he acquitted himself. After as much had been done as required his personal direction, he left his brother Grato to superintend the rest, and proceeded to Rome, where he spent some time in studying the remains of antiquity and architectural decoration. He next visited Naples for the same purpose, and, while there, was engaged by Vanvitelli to make a model for him, of his Church *Dell' Annunziata.*

In 1773 he was obliged to quit Naples, and return to his native place, Bedano, in consequence of some family affairs. It was about this time that the Palazzo Reale, at Milan, was building by Piermarini,* and he proposed to Albertolli, that he should undertake the interior decorations. The latter accordingly repaired to Milan, in March, 1774. A most cordial intimacy took place between the two architects, and Giocondo was in a short time left entirely to follow his own taste and ideas, in which he showed so much talent that the Milanese looked upon him as the restorer of sound architecture, and many of the nobility began to vie with each other in decorating their palaces. On the Academy of Fine Arts being founded at Milan, by Maria Theresa, in 1775, Albertolli was appointed professor of decorative architecture; and he was also furnished with another favourable opportunity of showing his taste and ability, practically, in the interior embellishments of the imperial villa at Monza, built by Piermarini, between the years 1775—9.

In the meanwhile the number of his pupils at the Academy greatly increased; and, in order to furnish them with better studies of ornamental detail than the capricious fancies then in vogue, he had many drawings of his own compositions — chiefly those which had been actually executed — engraved. The first part of the series (Ornamenti Diversi) appeared in 1782, and was dedicated to Piermarini. In consequence of the favourable reception that work met with, and in compliance with the advice of Prince Kaunitz, who urged him to bring out some other works of the kind, he published in 1787 that entitled "Alcuni Decorazioni di nobili Sale," and in 1796, his "Miscellanea per i Giovani studiosi del Disegno." After a similar interval of nine years, he produced his "Corso Elementare di Ornamenti Architettonici," in 1805.

Besides furnishing valuable instruction to the pupils at the Academy, and forming their taste by sound principles of art, these valuable publications contributed not a little to diffuse a better architectural taste in France and Germany, and to extend their author's reputation in other countries. Owing both to those collections of designs, and the taste displayed by him in the works he executed, he came at length to be regarded throughout Italy as a high authority in all matters of architectural decoration. Of his elegant fancy and taste in interior embellishment, ample proof is afforded by the splendid apartments in the *palazzi* of Prince Belgiojoso, the Marchese Cassendi, the Marchese Arconato, and Conte Antonio Greppi. He also designed the new façade of the Palazzo Melzi, in the Corso di Porta Nuova at Milan, and the noble villa belonging to the same family, at Bellagio on the Lake of Como.

After performing his duties at the Academy for thirty years, with so much credit to himself, and so much advantage to his pupils, a disorder in his eyes caused him to solicit leave to resign his office there, in 1812. Fortunately it proved to be only a temporary malady, and he afterwards continued to enjoy his favourite studies and pursuits to extreme old age. He was frequently consulted on various occasions, and, among others, in regard to the decorating and fitting up of the Duke of Torlonia's palace at Rome, on which works some of his own pupils were employed.

* Giuseppe Piermarini was a native of Foligno. He executed a great many structures at Milan, and among them the celebrated Teatro della Scala. He died in 1808, but the year of his birth we have been unable to ascertain. The following are some of his principal works, the Palazzo Belgiojoso, Villa Imperiale di Monza, the façade of the Monte or Public Bank, the Monte di Pieta, the new portions of the Academy della Brera, Teatro della Canobiana, Palazzo del Governo, and the Fountain in the Piazza della Fontana.

---

## MEASURING AND PLOTTING A HILL.

In no case, except that of a dead flat, does the measured surface of any piece of land correspond exactly with the base, which last is that which should, and indeed is the only surface which can, be plotted with perfect accuracy. If the surface is very much diversified by hill and valley, the real surface may be considerably larger than the plotted surface; but, whatever the difference is, it is always impossible accurately to plot the real surface. If great nicety is required in the plotting a plan, the whole must be brought down to the plane or level of the very lowest part, otherwise there will be distortion and error. If the lines measured by the chain are all straight, they may be at once reduced to the plane required, that is to their corresponding lengths in that plane; but if they are curves of vertical curvature, which is the most common form of the swells of hills, then the straight lines joining their extremities, or forming their chords, must be found by triangulation. Thus, if a surveyor is accurately to measure as real surface, and also to plan, a hill or any other uneven portion of ground, he must have two surveys, —a chainage for the actual surface, and a triangulation for the plan; and, if there are many characters to be represented in the plan, the placing of them is a matter that requires some judgment.

A question has been raised as to the comparative value of the surface of a hill and the level base upon which that hill stands; and, as ignorance always prefers that which gives it the least trouble, the vulgar conclusion is, that both are of the same value. In proof of this it is asserted that as many trees will grow on the base of a hill as on the sloping sides; and diagrams, such as one which appears in an article from a correspondent, in a former number of this journal, are produced as evidence of the supposed fact. The supposition is, however, a mere fallacy, evidently founded upon great ignorance of the economy of vegetables, namely, that they depend wholly on the earth for their growth and nourishment. Now, it is not true that any one plant is wholly dependent upon the ground; for all are, to a considerable extent, dependent on air, light, and heat; and there are hundreds of species which grow well, and yet never touch the ground by one fibre, or derive a single particle of nourishment from any solid substance whatsoever. More trees, even of those species which die the soonest after they are uprooted, will grow on the slope of a hill than on the base; for the roots of trees run parallel to the surface, not to the horizon; and therefore the roots that can be accommodated, and consequently the trees that can grow, are in proportion to the real, and not to the horizontal, surface; and the same may be said of all plants. No general ratio can therefore be established between the actual surface of a hill and the base on which that hill stands. It must be decided upon the circumstances of the individual case; for we have known many instances in which one acre of the hill was worth many acres of the morass and quagmire around its base; and as many in which one acre of the fields or meadows at the base was worth several acres of the hill. The conscientious surveyor will therefore return the actual surface, whether plane or sloping, as the area, and estimate the relative values of the different parts, if that is required of him; but he must in all cases get at the base for his plan.

Having made these remarks, which appeared to be necessary, on

account of a very common but very absurd error, we now proceed to give some account of the method of measuring a hill, so as to plot it accurately on its base. In doing this we shall make use of no diagram; and that for two reasons: in the first place, the subjects of which we have to treat lie in different planes, and thus they could not be represented in one diagram without a good deal of distortion, and distortion calculated to mislead those to whom the present article might be of use. In the second place, and it is far more important, we are of opinion, that diagrams are not only introduced *ad nauseam*, but that their continual introduction tends to enfeeble and render comparatively useless one of the most valuable faculties of the mind. There *is*, as we know from our own experience, such a faculty as that of converting the mind, as it were, into a black board and chalk, and making mental diagrams, far more complicated than any which are required in ordinary surveying, and yet as clear and intelligible, if not more so, than if we made them with our hands, and saw them with our eyes. The making and the using of them are, like all mental matters, very easy, and only require a little practice. When once this practice has been undergone, the party is apt to be both astonished and delighted at the new power which he has acquired. One whose pursuits, whether for the acquisition of knowledge, or for the purposes of business, lead him much to the study of geometrical figures, cannot help thinking of those figures, and of the difficulties which he feels concerning them, at times and in situations in which he has no means of making diagrams—such as when he is walking, or lying in bed not asleep. Both of these are admirable times for study, and the latter especially for difficult study, because there is nothing to distract the attention. But, if the subject requires a diagram, and the party cannot make and manage one mentally, that which would be pleasure is turned into mental annoyance of the most disagreeable kind; for the party fancies that he could get the better of the difficulty, if he were in possession of those helps which the circumstances forbid him from having; and on this account he is miserable. The remedy is, however, a very simple one; for a man has nothing to do but make himself very familiar with ocular diagrams, and he will find mental ones much more easily manageable than these. This faculty is not confined to diagrams; for one who has habituated himself to such matters can carry on a long algebraical operation when sleepless on his bed in the dark, and yet have it all as clear to his perception as though it were printed in a book. We know that these matters are fact, and that the acquirement of them needs no particular talent; and therefore we recommend them to such of our readers as are fond of mathematical studies, and have little time to devote to them.

But we must proceed to the measurement of the hill for the purpose of plotting it with perfect accuracy on its base; and, as a simple illustration is always the best, we shall suppose the hill detached, and the base of it nearly circular.

The first thing to be done is to place a flag on the top of the hill, in such a manner as that it can be distinctly seen from as near the base as possible all the way round. To accomplish this, it is of no consequence to what height the flag is raised on its staff, for it is not the height of the hill that we seek to know, but the true dimensions of its base. If, however, the height of the hill is any object, it can easily be found by subtracting the height of the flag from the total height resulting from the triangulations.

When the flag on the top is rightly placed, the next step is to choose stations round the base of the hill, and as near to it as the flag can be conveniently seen. If the hill is of small size, six of these will be about the best number; and they should be chosen at as equal distances as circumstances will admit.

These stations being chosen, and banderols, or small flags, placed at them, matters are ready for the survey. Two operations are required in this,—chainage and angular measurement. Of the first much is not absolutely necessary; for, if the distance between two of the banderols is very carefully measured, all the other lengths may be deduced from that. But the base line should be measured with a good joint chain of steel, and not the common ring one of wire; and the most level side of the polygon should be taken, and measured twice for fear of mistakes. It will, however, be very little trouble to extend the chainage to all the sides of the polygon enclosing the hill, as the theodolite must be carried along all of these lines; and the chain measurements, reduced to their corresponding horizontal lines, will serve as a check upon the results of the trigonometrical calculations. If the base line is on a slope, it will be necessary to take the angle, and reduce it to its equivalent horizontal line; and, if all the sides of the polygon are measured by the chain, the angle of deviation from the horizontal plane must be taken for each of them; but this does not affect the other angles taken by the theodolite, or the lengths of the lines which are deducible from them.

In using the theodolite, there are three essential angles to be taken at each banderol, or angle of the polygon which surrounds the base of the hill. Two of these are horizontal, one to the left and one to the right of the line from the station to the flag on the top of the hill, the banderols to the left and right forming the other limits of these two angles. In taking these angles the theodolite must be perfectly steady; and the horizontal plate must be adjusted by the levels. The other essential angle at each station is that of the elevation of the flag on the hill, shown as the vertical arc. If the chainage is carried all round as a check, the angles of elevation or depression of the two banderols or stations, one nearest on each side must also be taken; and, when all this is done, the data are complete.

The horizontal angles admit of a check to the whole amount, but not to the individual angles; for, if 360° is added to their sum, and the amount divided by 180°, the quotient should be the number of sides in the polygon, that is, the number of stations; and there should be no remainder. The vertical angles do not admit of any similar check. If it is desired to represent any objects on the slopes of the hill, in their true places on the horizontal plan, angles must be taken at the nearest line stations, between the object and the other station of the line; and the lengths of the lines forming those angles reduced to their horizontal equivalents will give the true position of the object.

After the data are obtained, there are two sets of trigonometrical calculations to be performed. First, to find, with the exception of the base line, which must be measured, all the lengths from station to station, and all the lengths from the stations to the flag on the top of the hill. The data for this, in every case, are, the angles and one side given, to find the other sides; and the analogy is very simple, namely,

1. As sine angle opposite given side,
2. To sine angle opposite required side;
3. So is given side,
4. To required side.

Logarithms are of course used; and the formula is, add the logarithms of the second and third terms; subtract the logarithm of the first; and the remainder is the logarithm of the fourth.

For reducing the oblique lines to the equivalent horizontal ones, the analogy is,

1. As radius,
2. To cosine elevation or depression;
3. So is oblique line,
4. To horizontal line.

By logarithms. Add the logarithms of 2 and 3, take 10 from the index, and the remainder is the logarithm of the line required. These results give a perfectly accurate plan; and they can be obtained in half the time which we have taken to describe them.

---

## MORSELS OF CRITICISM; OR, NOTES ON BUILDINGS.

### No. 1.

1. The new building for the Brewers' Almshouses, Owen's Row, Goswell Road, now in progress, affords a striking, yet little-needed, instance of utter disregard to site and locality; the south side of the building, which is, besides, the one most exposed to view, being left merely a naked back, not only without the slightest decoration of any kind, or any regard to design, but without retaining any vestige whatever of the style of the front, which is that of the later Tudor and Elizabethan. Were the latter part even much better than it actually is, it would still be exceedingly unsatisfactory, because, although the building is entirely isolated, the ends are left just as unfinished as the back itself; consequently, the front shows itself at once to be a mere mask; nor is the incongruity thus occasioned rendered at all less by the number of sham gables ostentatiously cram-

med into that side of the building, while nothing of the kind is allowed to appear elsewhere. That there was sufficient reason why the north side should be treated architecturally as the principal front, is not denied; because it immediately faces that of "Lady Owen's School," which is in the same style of architecture, and similarly executed in red brick and stone. We do not quarrel with the architect because he has made that the most important part of the exterior, but because he has utterly neglected all the rest; whereas, had he considered his subject properly at the beginning, he would doubtless have found means to keep up some tolerable degree of consistency throughout; more especially as only the upper half of the south front is visible, the rest being concealed by the garden wall; and, as there are very few windows there, a very little attention to general effect and character would have sufficed to keep up the appearance of style. How far it was under any circumstances advisable to make the dwelling rooms face the north, so as to exclude the genial and cheering sun from their aged inmates, is a point we leave to be settled by others. All we remark is, that the architect will doubtless be remembered by the occupiers in all their orisons.

2. It is frequently a mere trifle that absolutely spoils and stultifies a design, of which provoking perverseness we meet with an egregious instance in the small portal in Oxford Street, leading to the Princess' theatre. The effect that would else be produced by the two caryatides and the other architectural embellishments is altogether nullified by the barbarous meanness and vulgarity of the window between those statues. Were that intolerable eyesore expunged, and a triple window of tasteful Grecian design substituted for it, and brought forward so as to afford the architrave that support which, owing to the distance between the caryatides, now seems to be required, the whole might have been rendered both an elegant and an original composition.

3. There is a vast difference between law and religion: at all events, the former has not afforded that patronage to architecture which the other has done. Look at all our inns of court; they are, almost without exception, the dullest, dirtiest, dismallest dens imaginable: we might imagine that the dirty work going on within infected the very atmosphere without, and the outsides of the buildings themselves. Regarded as architecture, they are at the best but mere barracks; huge ranges of brick walls crammed with most sluttish-looking windows, partaking neither of the sublime, nor the beautiful, nor the picturesque. Yet, picturesque they certainly might be; since there would be no finer field for an architect of any taste than such places as the Temple, with its labyrinth of courts, now withering the eye by their repulsive gloom, sordidness, and dulness. Had structures been reared by the hand of taste, the district about Temple Bar might have almost rivalled Oxford; for we scarcely need remark that the collegiate style would have recommended itself as a matter of course. What a succession of interesting architectural scenery of that kind might Gray's Inn, Lincoln's Inn, and the Temple, have then presented to us! all shut out from the noise and turmoil, and incessant hubbub, around them. Instead of which, the modern Gothicizings and Smirkefyings, which some of them have here and there undergone, are worse than doing nothing. A stone building for a new library is now erecting in the outer court of Gray's Inn, which is many degrees better than the Gothicizings alluded to, yet of no extraordinary merit otherwise than by comparison; it being too small, too plain and unpretending, to give any architectural importance to the court itself.

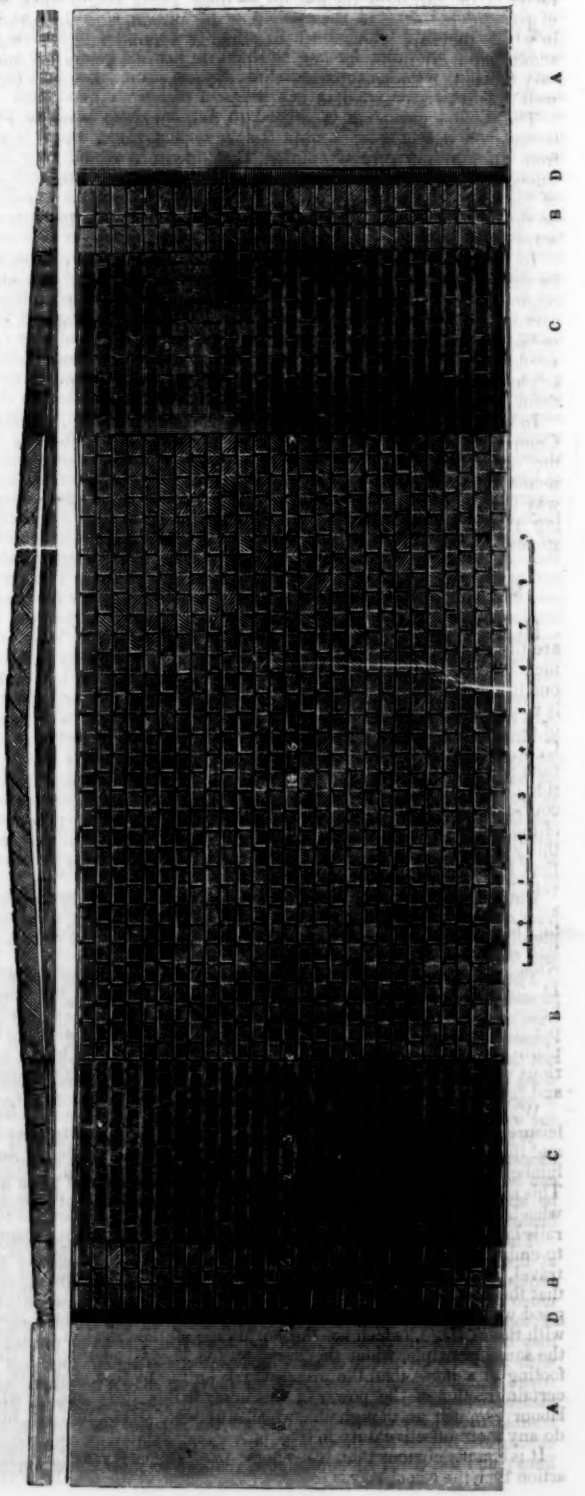
---

## PROPOSED IMPROVED PLAN FOR PAVING STREETS.

Sir,—Will you permit me to lay before your readers the accompanying sketch of a mode of street-paving which, I think, might be advantageously adopted in some of the leading thoroughfares of the metropolis.

It is intended to obviate one of the most formidable objections to the general use of wood pavement; that of the horses slipping, when pulled up suddenly; and I am sure would be found especially useful in the Strand, Oxford-street, Holborn, and other crowded streets, where the great number of omnibuses require more than ordinary care to prevent the frequent recurrence of accidents.

These vehicles are continually stopping to set down or take up passengers, and, when we consider the clumsy and awkward cha-



# CONSTRUCTION OF BRIDGES IN GERMANY,

## BY M. LAVES.

*Fig. 1.*

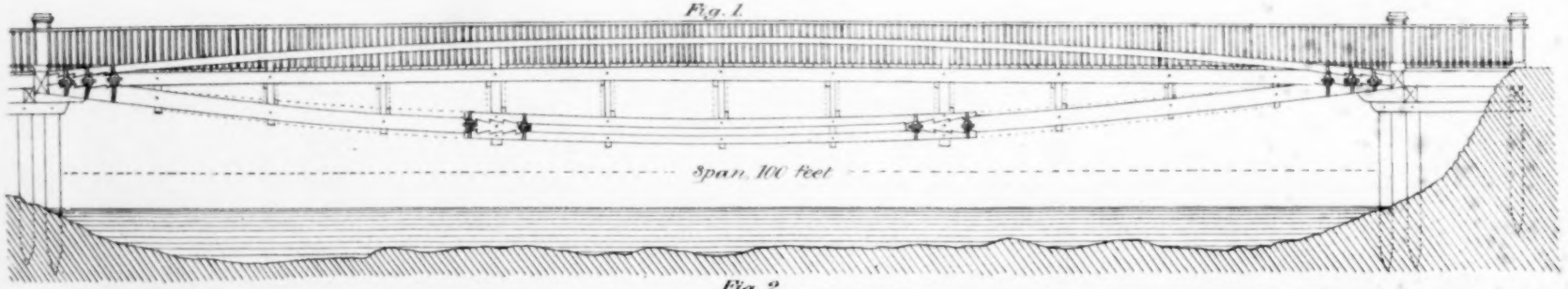



*Fig. 2.*

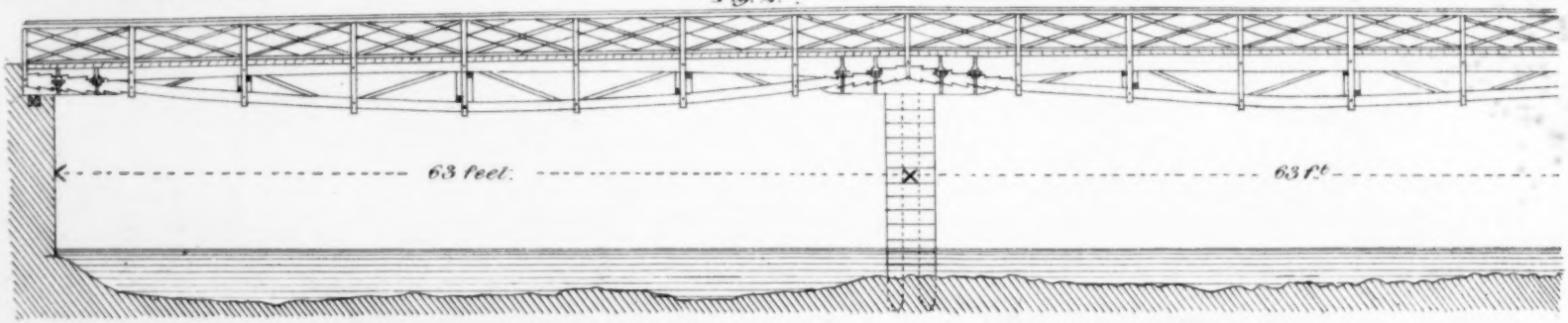



*Fig. 3.*

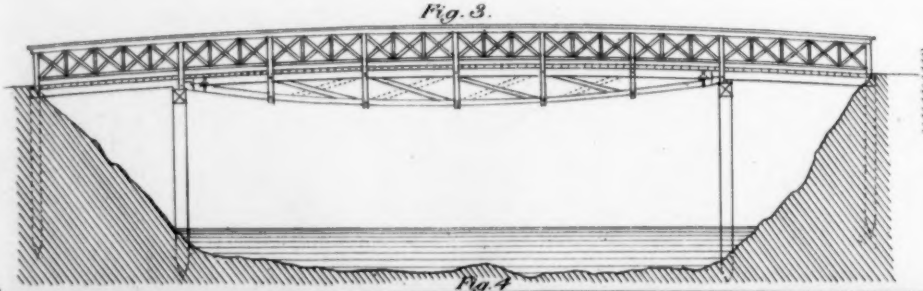


*Fig. 8*

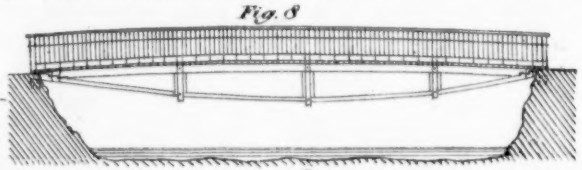


*Fig. 5.*

*Fig. 4*

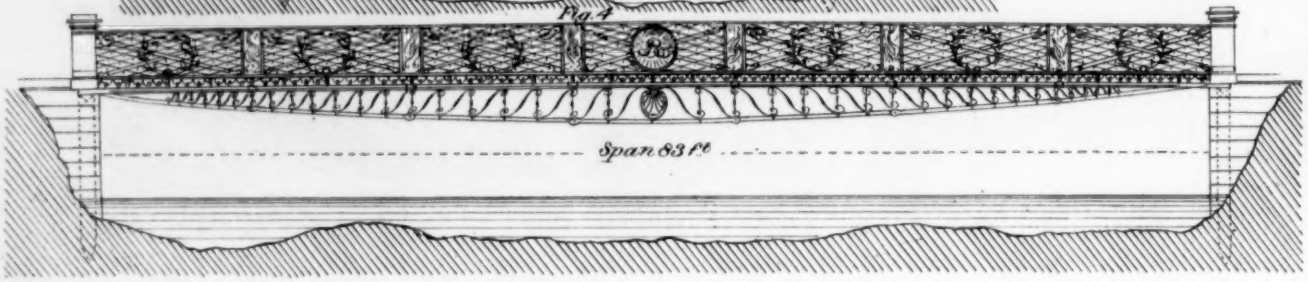
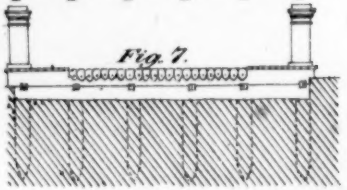



*Fig. 6.*

*Fig. 7.*



S. Straker Lithe 118 Bishopsgate St.

London, Published by Grattan & Gilbert, 51 Paternoster Row, Dec.r 1. 1840.

racter of the carriages themselves, — their great weight when full of passengers, — the reckless way they are driven, and the manner in which they are stopped when going at a rapid rate, we must admit that every improvement, in the least degree rendering more easy the toil of the poor horses which draw these ponderous *arks*, is well worthy of our attention.

The wooden pavement, from the easy draught of carriages over it, is decidedly one of these improvements, and is only objectionable from its extreme slipperiness in wet or frosty weather. At such times, it is scarcely possible to pull up a horse on it without danger of his falling, and I apprehend that, however favourable to it may be the opinion of the public in other respects, this objection will always weigh very strongly against its universal adoption.

In the plan I propose, the advantages of the wooden pavement, its cleanliness, freedom from noise, ease of draught, and presumed economy, are still preserved, the only difference is that of having a certain breadth near each side of the street, laid with stone in the ordinary way. On this the horses might travel, while the wheels would still run easily and noiselessly on wood, and the horses might be readily pulled up without their feet slipping from under them, as they do on the wooden blocks.

In my sketch, I have chosen the Metropolitan Wood Pavement Company's plan, which (without volunteering an opinion as to the comparative merit of the different plans before the public) seems to wear very well, and to give general satisfaction. The footway is proposed to be of asphalte, the specimen at Whitehall proving that this composition is vastly superior to paving with flagstones.

Your obedient servant, EDW. LOMAX.

*Queen Square, Westminster, October* 20, 1840.

[It will be understood that, in the sketch, the portions marked A are the side pavements, or footways, to be laid in asphalte as recommended; B, B, B, are the wooden pavements, consisting of a broad one in the middle, and a narrow one towards each footway. If there is room for three or more carriage-ways in the street, the surplus is, of course, to be left in the middle, or broadest wooden pavement. C, C, are the granitic pavements for the horse-ways, one towards each side of the road; and, of course, to be used so that the near side of the carriage shall be towards the foot-pavement. This will, of course, tend to confine the taking up and setting down to that side of the street near which the carriage runs; but, when once known, this would be far more regular and free from chance of accidents than that zigzagging from side to side of the street with lumbering vehicles, which is always unseemly, and often not a little dangerous, according to the present mode. Pavements of this kind would have this farther advantage, that they would tend greatly to the prevention of racing between omnibuses, which is disgraceful under all circumstances, and eminently dangerous in crowded thoroughfares. D, the cast iron side drains or gutters, with gratings to the sewer below, in whatever situations they may be required. The corresponding parts of the plan and section in the cut will practically explain each other; and we would recommend this method to the serious consideration, at least, of all who are interested in the economy and comfort of the streets.

We are not sure whether our respected correspondent has had leisure to consider all the benefits of his project; but there is one, and that a very important one, especially in the case of clumsy and lumbering things, like omnibuses, of which he has taken no notice. This is the difference of consistency between the surfaces on which the wheels run and that on which the horses travel. On the temporary rails laid down by contractors for removing materials from cutting to embankment, the space between the rails, along which the horses travel, is generally very badly ballasted, and the consequence is, that the horse expends a considerable fraction — say one-twelfth in good weather, and more when the weather is bad, in keeping pace with the carriage, which has the advantage of the rails; and, upon the same principle, when the horse-way is less favourable for the footing of a horse than the wheel-way is for the motion of wheels, a certain fraction of the power of the horse will be lost; and he will labour as much as though the wheel-way were worse, and yet not do any more effective duty in traction.

It is equally obvious that, if the horse-way is more favourable to his action than the wheel-way is to that of the motion of wheels, the horse will have a surplus of power by which to bring forward his load; and if the wheel-way is also the best that the circumstances will admit, the real duty done the maximum, with an equal exhaustion of the animal.

Now, we are not sure — for there is no absolute certainty in such cases but direct and well conducted experiment — we are not sure that, if both are duly made, this granitic pavement for the horse, and wooden pavement for the wheel-way, is not the very one which shall enable the animal to work with maximum effect; and, what with the saving of loss and the acquiring of gain, it might probably spare the horse twenty per cent., or one-fifth of his present exertion with the same load. This would be a most important and substantial relief to the animal, a corresponding profit to his owner, and it would save the feeling part of the public the pain which they now daily receive from the cruelties perpetrated upon those horses which work in public conveyances along the streets of the British metropolis. In order to give the horse constant *points d'appui* for all his feet, the surface of the granite blocks would have to be furrowed, or perhaps it would be more advantageous to have them pricked in the same manner as the coarser sort of millstones. Upon such a surface a horse would have no tendency to lose his pull by slipping; neither would he stumble, or the carriage be apt to throw him down, though proceeding at the swiftest pace allowable in streets.—CON.]

---

## CONSTRUCTION OF BRIDGES IN GERMANY.

BY M. LAVES.

WITH ENGRAVING.

FIG. I.—This represents the elevation of an oak bridge at Hanover, built in the year 1835, the cost of which came to somewhere about £112. It was only intended for foot passengers, and therefore the width is only 12 feet. Its appearance is very ornamental and substantial.

FIG. II.—This is a bridge in fir, over the Eger, at Altsaltel, in Bohemia, the total length of which is 126 feet. The width of this is greater than the preceding, being 15 feet, and therefore offers a thoroughfare for carriages. This bridge is divided into two spans, the length of each being 63 feet, and the cost of construction was about £100. This is characterized by a very light and not inelegant appearance.

FIG. III.—This bridge is likewise constructed of oak, and cost something about £70. Its length is 60 feet, and width 15 feet, and therefore, like the preceding, accessible for carriages. Its locality is at Dernebourg, near Hildesheim, over the Nette river. This would prove very attractive to the grounds and parks of gentlemen, the expense being hardly a consideration.

FIG. IV.—This represents a very handsome bridge in wrought and cast iron, in the royal park of Herrenhausen, near Hanover. Its span is 83 feet, with a spacious width of 20 feet. The cost of construction, with the addition of the wood-paving for the carriage-way, and other items, came to about the sum of £530. This certainly presents a very chaste and beautiful appearance, and the very elaborate manner in which the ornamental part has been carried out has made no small portion of the expense. Figs. V., VI., VII., represent transverse sections of this bridge, and explain the system with more perspicuity.

FIG. VIII.—This is a small light bridge, with only 36 feet span and 5 feet wide, constructed over the Eger at Elnbagen, in Bohemia, for foot passengers. It is built of fir, at the very moderate cost of fifty shillings. For the other particulars we refer to the plates.

[From the sketches and the notices above given, the reader will be enabled to judge of the appearance and the price of these German contrivances; and thus, in so far, to compare them with the ordinary styles of bridge-construction. Still, however, several elements are wanting before that comparison can be made in a satisfactory manner. The bridges, it will be observed, are, with one exception, constructed entirely of timber; and thus the cost of timber and of carpenters' labour are both wanted before any decision can be come to with regard to the propriety of constructing such bridges in this country. 1*s.* 4½*d.* is unquestionably a very low price per foot for a

foot bridge of 36 feet span; and £1 : 3 : 4*d.* is also a very moderate price for a carriage bridge of 60 feet span; nor is about £6 : 8*s.* in fact at all out of the way for a handsome iron bridge, such as Fig. IV.

Then comes the question of strength, or rather the two questions of strength and beauty, because one at least of the examples given is an ornamental bridge. Now, with regard to the first of these, there is no doubt that the trussed beams—for such they are, must be stiffer than simple beams containing the same quantity of material. It is also obvious that the weight of the bridge itself is reduced to simple vertical pressure upon the abutments, and on the piers where there happen to be any, as there is one in Fig. II. of the sketches. The support of the bridge is thus reduced to resistance of pressure in one direction, at each of the points of support; and thus the strength necessary to afford this resistance is more easily calculated. But though the bridge is made stiffer by the trussing, no means are provided by which the pressure on it can be distributed over the whole, and the entire bridge may be brought to the support of a load at every point of it, as is the case with Mr. Dredge's suspension bridge. Upon any of those bridges, the lever power of a carriage or other weight, just entering on either abutment, would be 0, that is independently of the mere dead weight. At every other point, the leverage would be as the product of the two distances from the abutments, or nearest points of support; and at the middle this leverage would be a maximum, that is, it would be in the ratio of the square of half the space; and this in addition to the dead weight, or simple pressure of gravity, in the carriage or other weight passing over; and, as each of these two pressures, or strains upon the bridge, may vary while the other remains constant, the absolute strain or tendency to break down the bridge will be as their product. To compensate this by transferring any portion of it in another direction, there are no means; and the weight of the bridge itself of course follows the same law, if indeed it has not an extra weight at the centre, arising from the cross pieces necessary for keeping the strut and tie apart from each other there. Therefore, though there is unquestionably additional stiffness in such a bridge, there is not in it a single new element of strength.

Then, its appearance is the very reverse of being handsome; for, though the strut and parapet may be made to rise as high above the horizontal line as the tie descends below it, the whole bridge still has the appearance of "lagging," and consequently a weakness at the middle point; and, although this weakness is only apparent, it gives the same unpleasant feeling, especially in an ornamental bridge, as though it were real. Such is our casual opinion; and the data are too imperfect for enabling us to give a positive decision either for, or against, the mode of construction.—Con.]

---

## ON THE FALLACY OF THE COMMON SYSTEM OF BRIDGE BUILDING.

By James Dredge, Bath.

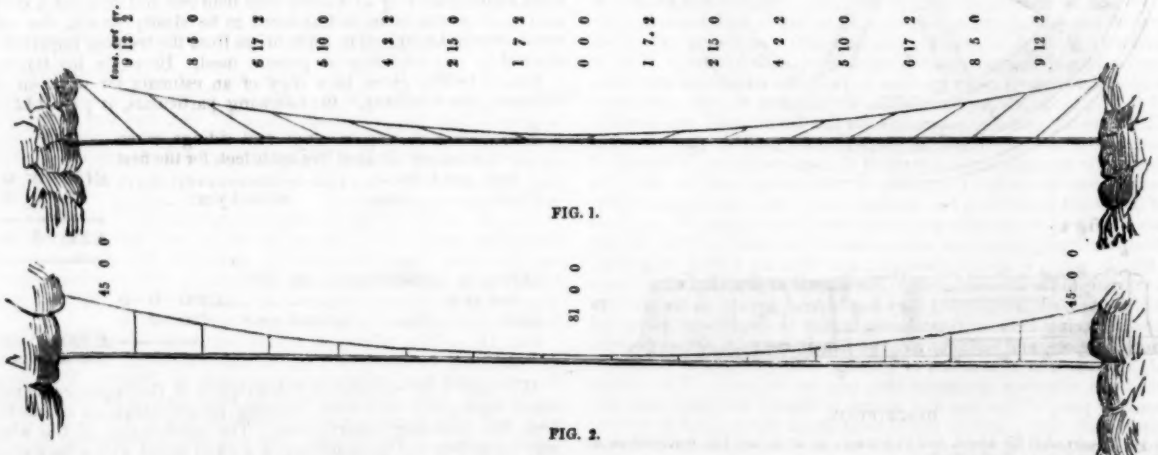



FIG. 1.




FIG. 2.

These figures represent the new and a common suspension bridge, and the strains at various points to which they are exposed by their own weight and position. They are 10 feet deep, 180 feet long each,* and are of equal bases. The ultimate strength of each is 100 tons, the weight of fig. 1 is 6 tons, and that of fig. 2 (as it is the same size throughout) 18 tons. In the former, the strains on the curves at the abutments are only 19 tons 5 cwt., with no central strains or undulation; but, in the latter, the strains are 90 tons at the abutments of the curves, also 81 tons at the centre, and the undulation to which it may sometimes be exposed is even more destructive than its weight. Thus, then, the actual strength of fig. 1, for transit use, which is the only object of a bridge, is 80 tons 15 cwt., whilst that of fig. 2 is only 10 tons. Hence the advantages of the former over the latter are *stability and eight times the power, with a third of the materials;* and these are still greater in more extensive bridges.

To find the strains of fig. 1. Rule. Multiply a third of the weight by the length, and divide the product by twice its depth, to which add the remaining weight. Example. $2 \times \frac{180}{10} + 4 = 22$, total 22 tons; from which deduct the support afforded by the first rods nearest the towers, which is ¼ in this bridge; the remainder is the amount of strains on the bases of the curves.

To find the strains of fig. 2. Rule. Multiply half the weight by its length, and divide the product by twice its depth; this gives the central strains, to which add the remaining weight for the two abutment strains on the curves. Example. $9 \times \frac{180}{10} = 81 + 9 = 90$.

Position is the only distinction between suspension and compression bridges, the curves of the former are below, and those of the latter above, their bases; reverse the figures, and the fact is proved; or, see Lord Western's clear explanation of the bracket, in his letter to Lord Melbourne on this subject. In which position is iron strongest? is a question that deserves the greatest attention. In the perpendicular, which is the most powerful situation of compression, an inch bar 20 feet long is powerless; but on suspension, the same would sustain nearly 30 tons. If tapered, it would sustain

* Depth is the deflection of the arch — length is the distance between the abutments.

its own length, 60,000 feet; therefore, spans to 4,000 feet extent can be effected with safety, and the cost of such bridges will be as nothing in comparison with their utility.

The only timber required in the construction of suspension bridges is for the flooring, which can at any time be easily repaired, without interfering with the frame; nor can this be objected to, since we now pitch our streets with wood.

---

## PATENT IMPROVED METALLIC RAILWAY WHEEL WITH WOOD-FACED TYRE.

Fig. 1.

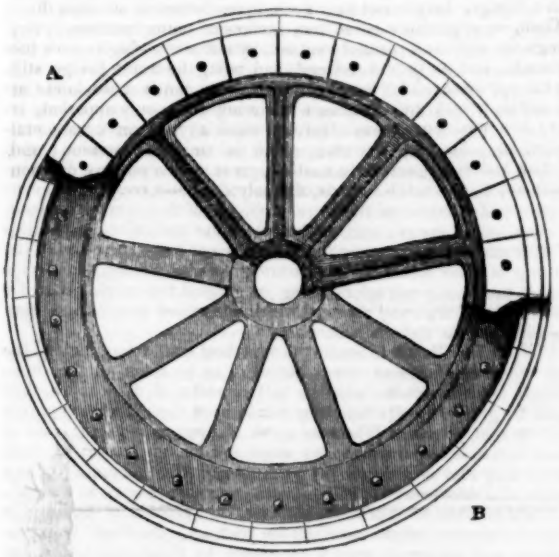
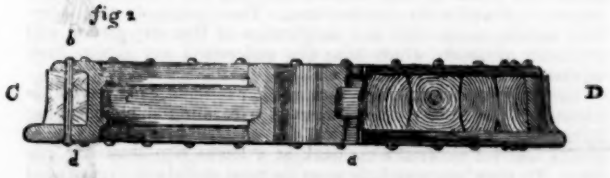



fig 2




### DESCRIPTION.

Fig. 1 represents the wheel, half in section, as at A, and half complete as at B; the view being a front elevation.

Fig. 2 an external edge view at D, *a*, and C, *a*, a transverse section. C, *b*, *c*, *d*, shows the channel tyre, in which the wood, C, is inserted, and fastened by the pin on rivets, *b*, *d*.

Wooden wheels were originally in common use on railways; these were afterwards superseded by the extensive use of cast-iron wheels; and both of these descriptions of wheels were much improved by manufacturing them with wrought-iron tyres. Modifications of these wheels are still in use on the Liverpool and Manchester Railway, the wooden wheels having the nave of cast iron, and the spokes and rim of wood, the tyre being of wrought iron. On the London and Birmingham Railway, cast-iron wheels are extensively used. On the continent of Europe, and in America, *cast-iron* wheels are seemingly employed by preference; and are no doubt quite as safe for travelling, where great speed is not practised.

In England, a decided preference is given to wrought-iron wheels, in which this metal is used throughout, with the exception of the boss being *cast* around the ends of the spokes. The latest improvement on these has been the making of the entire wheel, including the boss, of wrought iron.

The wheels now in general use derive their chief novelty from the construction and placement of the spokes, with a view to obtain elasticity, strength, and durability. One variety which does not come under this denomination is the plate wheel, supposed on its introduction to possess some peculiar advantage in overcoming a supposed resistance of the atmosphere. Except, however, in relation to variations in size, the present wheels are little more than varieties in pattern. The common diameter of carriage and wagon wheels is three feet, and the largest driving wheels for locomotives are those employed on the Great Western Railway, being six to seven feet in diameter,—though at one time they were made as large as 10 feet.

The action of an iron wheel on an iron rail, though derived from a rolling motion, can only be compared to a series of blows, and the rebound occasioned by iron striking iron is well known to be considerably greater than is produced by striking wood on iron. To this simple fact we may trace the tremulous motion occasioned by iron wheels on an iron railroad; and when by any trifling accident, as an inequality from the rising of one end of a rail, or sometimes even from small flinty pebbles getting on the rail, the rebound is not more fearful than dangerous. The tremulous motion of the rail just adverted to renders it necessary in most cases to lay the rails on wooden sleepers. As an illustration of what is meant, it may be mentioned that on the Dublin and Kingstown Railway the rails were originally laid on granite sleepers, but the tremour was so great as to loosen the rails and occasion serious fears from the consequent damage sustained by engines and carriages passing along the line. It was, therefore, ultimately agreed to take up the granite and lay down longitudinal wooden sleepers, a work of considerable labour and expense. In some cases the nature of the soil or sub-soil may allow the use of stone blocks; and where they can be applied with safety they are preferred, for the reason that a road laid on *stone* blocks can be kept up at a lower rate than one laid on *wooden* sleepers; and, as has been endeavoured to be clearly shown, the only reason for laying the stone aside arises from the tremour imparted to the rail by iron wheels as at present used. Brees, in his Railway Practice (1839), gives, in a copy of an estimate for work on the "North Union Railway," the following particulars, at page 142:—

| | | | |
|---|---|---|---|
| Maintaining railway crossings and sidings, when laid on stone blocks of five cubic feet, for the first year, per mile..... | £150 | 0 | 0 |
| Ditto ditto, second year ..... | 80 | 0 | 0 |
| | £230 | 0 | 0 |
| Ditto, on larch sleepers, for the first year .....£200 0 0 | | | |
| Ditto ditto second year 120 0 0 | | | |
| | £320 | 0 | 0 |

We shall now proceed to a description of the improved metallic wheel with wood-faced tyre, showing its advantages in connection with the preceding observations. The construction of the wheel may be understood by imagining a spoked wheel with a deep channelled tyre. The wheel may be made either of cast or wrought iron, it having been ascertained that tyre bars can be rolled to the required pattern. In this channelled tyre are inserted blocks of African oak, measuring about four inches by three-and-a-half inches, solidified by filling the pores with unctuous preparations; thereby counteracting the effects of wet by capillary attraction,—to which, by this means, it becomes impervious, and at the same time is not liable to unequal contraction and expansion. The blocks of wood are cut to the requisite form to fit very exactly in the external circular channel of the wheel, with the grain placed vertically throughout, forming a complete facing of wood, as shown in the engraving. There are about twenty-eight to thirty of these blocks round each wheel, where they are retained in their place by one or two bolts passing through each, the two sides of the channel having corresponding holes drilled through them for this purpose: the bolts are then well rivetted. After being so fitted, the wheel is turned in the usual manner. The wheel when finished has all the appearance of a common railway wheel, but with a rather deeper rim, the tyre faced with wood, and the flange of iron. Woods of various qualities may be used, whether hard or soft, requiring different chemical prepara-

tions according to their porosity, and in some instances requiring to be compressed.

The several advantages which this wheel possesses are —

1. That the wood facing will wear a considerable time without requiring any repair.

2. That the wood can be refaced, by turning it up again in the lathe, as practised with worn iron tyres.

3. That the tyre can be re-faced with wood at little expense, and at a far less loss of time than usual. In the operations of re-facing these wheels, or putting in new wood, the work can be performed without the labour and cost of removing the wheels from the axles, which in the keying and unkeying is known to be very troublesome.*

4. That, in regard to their working, it is the opinion of practical engineers, confirmed by actual experiment, that they will work smoother, easier, and as some have expressed it, more "sweetly" than iron-tyred wheels; with the advantage of going well in wet weather, even upon inclines, — having sufficient adhesion to the rail, without dropping sand to assist them in this respect, as practised when iron wheels are used.

5. That another and very important result will be, that the rails themselves will suffer less wear by using this kind of wheel, and that the fastenings, sleepers, and blocks, will receive considerably less injury, and thereby favour the laying of railroads on stone blocks, wherever they are considered to be most desirable.†

A metallic wheel with a wood-faced tyre, which is the principle of this construction, obviates most, if not all, the difficulties which have been experienced, whether in the use of wooden, cast-iron, or even wrought-iron wheels. Cast-iron wheels may, indeed, now be considered not far short of being equal to wrought-iron wheels, for safety and durability, with all the superiority of which the application is susceptible. They are also neither clumsy nor inelegant in form, and are capable of being made to any pattern, even for carriage wheels for common roads. It may, therefore, very possibly occur that they will have the effect to bring cast-iron wheels into as general use and as much reputation here as on the continent. This new construction and simple adoption of wood makes excellent driving wheels for locomotives; it may be readily stopped by using a cast-iron brake, and does not undergo that wear which might be expected from the friction it then has on the rail. The wood, by use, becomes exceedingly close and firm, acquiring a surface not easily distinguishable from metal in appearance.

These wheels have run unimpaired on the St. Helen's Railway for upwards of three months daily, carrying an average load of five tons; they are manufactured by Messrs. BROCKLEHURST, DIRCKS, AND NELSON, Millwrights, Engineers, and Iron-founders, Liverpool; where they may at any time be seen.

---

## EARTHWORK UPON RAILWAYS.

EARTHWORK, or excavation and embankment, was one of those subjects which for a long time set all calculation at defiance. Engineers had thus no data upon which they could subject this part of a work to any thing like a regular estimate. Thus they had to depend chiefly upon the opinions of contractors, — of those very contractors who were afterwards to execute that work the cost of which themselves had estimated. They, of course, took care never to be too low; and we have known instances of contracts, of considerable amount, by which the contractor cleared full 400*l.* per cent. on his total expenditure. This, it must be admitted, was an excessive, and even a shameful, profit; but in the case of an extensive work neither owners nor engineer could help themselves, though the latter might have been inclined to do so, which is alleged not to have been always the case.

Be that as it may, the business of excavating was involved in a mystery which ordinary vision could not penetrate; and though nobody could very well tell how the favoured, that is, the successful contractors went on accumulating money more rapidly than any other class of persons, except government contractors during the war, yet the real source of their vast gains was never fully developed, and perhaps did not admit of development. In the case of the contractors for an excavation, great as were their profits, all seemed perfectly right; and, according to the knowledge of the operation which then existed, all probably was right. There was no science of excavation which a man could bring to the work; and, though more skill was required than people generally supposed, yet every individual contractor had to find out his skill by his own personal observation and experience. The consequence was, that this description of work, on the great scale, became a close monopoly in the hands of the initiated few; and if any interloper had the temerity to take a large contract, even upon better terms than those initiated few, he was sure to lose under any circumstances, and if not a rich man, to be entirely ruined, by not being able to complete his contract, having it foreclosed, and being sued for the penalty, which last involves his securities in loss, if not in ruin, and thus turned his friends into enemies without any fault or wrong done on his part. This was a form of terrors which no poor man durst venture to grapple with, and rich men had but small inducement to risk their money in a game so hazardous, great as the profits of the winners were known to be. Thus, the only competitors which the contractors had to fear were the more intelligent of their own squadsmen, or overseers of gangs; and, as they were the professional favourites of their masters, and among the most efficient helps these had in the making of their fortunes, they were grown as a succession — the sons of the great contractors being in general too mighty men for following that craft and mystery which had raised their fathers from the wheelbarrow and the mattock.

The parties alluded to made the very best contractors, indeed the only good and efficient ones, that were to be found at the time; though, like all persons who are in possession of monopolies, they made far greater profits than they would have done in a trade purely open to competition. When we speak of monopoly in the case of those excavation contractors, we must not be understood as even insinuating that any law, or any party *gave* them a monopoly of any description whatever. The contracts were always open to the public; and any one of approved character, and capable of finding the requisite sureties, might have had the contract. No doubt both proprietors and engineers gave a preference to these contractors, because they could be depended on as doing the work in the best manner and within the specified time. Their monopoly was, therefore, nothing more than one modification of that very natural and necessary monopoly which those who understand any subject have against those who are ignorant of it.

Even the engineers, whether principal or resident, knew very little about that part in the management of excavating and embanking by means of which the contractor was enabled to make his large profits, and yet undertake the work at a lower rate than any one else. To show how very little even the most skilful and experienced engineers knew about excavation and the resources of which an intelligent and practised excavator could avail himself — and we doubt if they are better informed even now — we shall mention a case which came within our own personal observation. An extensive excavation was required under circumstances of peculiar difficulty, and no one acquainted with the nature of the job seemed inclined to offer for the contract. At last some stranger, possessed of sufficient funds, and able to produce the requisite securities, seemed willing to undertake the job, but at such a price as startled the engineer. The excavation of it had become absolutely necessary; and the engineer went to take another look at it before closing the contract; and while he was doing so, an experienced contractor, whom he had often employed, offered to do it at half the price demanded by the other offerer. The engineer was astonished; but the best of all securities, the deposit of the money, was offered; the contract was entered into; and the contractor, taking his own way of doing the work, completed it much within the stipulated time, and cleared fully £300 per cent. Thus, in addition to making this immense profit, he saved the owners a full half of what the work would otherwise have cost.

The engineer alluded to was not one of those who break into the profession by a side wind, for the conducting of some particular, got up job, and who are sure to execute their own reputation, whether

* As, in every thing affecting Railways, it is a desideratum to decrease the expense as much as possible, it may here be mentioned that three-feet cast-iron wheels, with wood-faced tyres and wrought-iron axles complete, can be made much cheaper than the generality of wheels.

† On lines situated like the Greenwich Railway and the Blackwall Railway, wood-faced wheels would diminish much of the noise which at present is a source of general complaint.

they may execute the job or no; he had been regularly bred, was largely employed, and among the foremost, if not the very foremost man of his time.

Why should this ignorance exist upon a subject which, in the greater works, is the most important and most costly of the whole. It cannot be that an engineer thinks digging ditches in one place, and forming mounds in another, below his notice; for a conscientious engineer notices every thing, and more especially such as are to absorb a large portion of those funds in the expenditure of which he is the steward. The real cause seems to be that engineers have never had to investigate the arcana of the craft and mystery of excavation. We have had instances of stonemasons and millwrights becoming engineers — and we are inclined to think such are far more efficient than those who have nothing to bring to the profession but school-craft; but we know of no engineer that was bred an excavator. We have heard engineers consult excavators, and get most valuable advice from them; and we have heard as sound opinions on all the parts of a great work given by an excavator as ever we heard given by an engineer, but still we know of no instance in which an excavator has become an engineer by profession. From what we have observed, however, we are fully convinced that the deficiency is on the part of the engineer; and that he is far more ignorant of excavating than the excavator is of engineering. Nimmo was perhaps an exception, and a brilliant exception to this. But he was a man *sui generis* — one who mastered every thing to which he turned his attention; and whose attention nothing could escape.

We have been led to these remarks by the perusal of a small volume entitled, "A PRACTICAL INQUIRY INTO THE LAWS OF EXCAVATION AND EMBANKMENT UPON RAILWAYS," * and which is, so far as we know, the first British publication of the kind. Although the volume is anonymous, the date of the preface leads one to conclude that the author has been employed at Bredon, on the Birmingham and Gloucester line, where there is deep cutting adjoining a good deal of embankment. The author deserves great credit for having spent his leisure time to so good purpose; and if all resident engineers would follow his example, and collect and publish the results of their personal observations, the profession and the public would soon be in possession of a body of most valuable information. The fact, that contractors for excavation took their contracts lower than any body else could afford to do, proves that there was something connected with the matter which the public ought to know. That every ingenious man should be paid, and well paid, for his ingenuity, is perfectly just and right; but if, from general ignorance of any thing connected with it, a public work is made to cost twice as much as it really should cost, the public are deprived of another work of equal value. For this, and for various other reasons, we feel convinced that the intelligent part of the public, but more especially every engineer, should know something near the price that ought to be paid for every thing connected with a public work; and that the more expensive such a work is, the more necessary is this knowledge.

Railway excavation and embankment form only one section, and that a comparatively large section, of the whole purpose and process of the work. All that is required is, that the excavator shall keep as nearly to the line given him by the engineer as possible: it cannot be exactly done in all cases, because of the blunders in the section; and when he comes to any of these, he must just cobble and conceal them as he best can. Then he has to make the slopes of his cuttings and his embankments in such a manner as that they will stand, at least for a time. But he needs not be very particular as to whether what is taken out of the cutting shall just suffice for the embankment; for if he has too much material he can "spoil," or spill, it over the side of the embankment, where it will do good rather than harm, and cost less in the removal than if it were tipped over the battery head of the embankment; and, if he is deficient, he can obtain it from a side cutting.

Besides, the railway excavator has seldom, if ever, any occasion to raise any of the stuff from his deep cutting to the bank; and thus all the removals of what he excavates are of the simplest and cheapest kind. Then, he has no absolute level to preserve, as the canal excavator has between lock and lock; neither has he any puddling in order to keep his work water-tight, or any hydrostatical pressure against which to provide; he has only to find a firm bed for the sleepers according to the section given him; and when he has done this his work is at an end. No doubt he has some difficulties to contend with; for the engineer or the surveyor may not have made due examination of the strata; and thus the slopes may not stand, or the matter of the deep cutting may be the very worst for the embankment. When such things have happened, we believe the practice of the parties has been to say as little about it as possible, and try to bolster it up in the very best way they could.

Limited as are the circumstances connected with railway excavations, as compared with those of excavations in the most comprehensive sense in which the word can be used, the object of the volume before us is still more limited. It relates only to one problem, — the time and power necessary to bring a given quantity of material from cutting to embankment, the length of the "run," or distance over which it is carried being also given. Now, we are of opinion, that as the subject is quite new to most readers, the only judicious plan that the author could pursue was to take, as he has done, one general problem, to ground his argument upon experiments which he had actually seen performed, and to follow out the problem in all its cases. All this he has done, and we must say, and we feel pleasure in saying, that he has done it in a very clear and luminous manner, and withal so simply in the expression, that the man must be dull indeed who does not fully understand it after an attentive reading. The formulæ, indeed, may have a little of formidable aspect to those who are not familiar with expressions of the kind, but they are so immediately in juxta-position with verbal explanations that no reader can have any difficulty in understanding and using them.

The great problem to the investigation of which the book is directed is, as we have said, the removal of materials from cutting to embankment; and in such a way as that all the men, horses, and other powers employed, shall be constantly at work, and that in so regular and uniform a manner as that what has to be done may be equally distributed over all, and none either over-worked or idle. The work is calculated to the quantity which may be done in any given time with any given power; and also for the maximum that can with the greatest advantage be done upon a work of any given magnitude. This information cannot fail in being highly useful both to engineers and to contractors; because, by knowing the rate of wages, the cost of implements, apparatus, and the wear and tear of them by any given quantity of work, all of which can be found for the particular case, the actual expense of any cutting and embankment may be found with a very great degree of nicety. The formulæ are given for horse power, for locomotive engines, and for men wheeling barrows; and the circumstances are pointed out under which each of these may be employed to the greatest advantage. All the ways of discharging the materials are also pointed out; and the allowances and changes that ought to be made in the power when the runs are varying in length, by the recession of the cutting, the advance of the head of the embankment, or both. Connected with the investigation of the power, there are some very pertinent remarks on contractors' rails, that is, the temporary rails which contractors lay down for the transit of materials; and the conclusion from these, though not formally drawn by the author, is, that the contractor is a loser in the end, in proportion as he lays down his rails in an imperfect and slovenly manner. It is also shown that, if the horse track between these rails is badly made, a considerable portion of the power of the horse is expended in moving himself forward, over and above what would be required on a hard and smooth turnpike road; and that the horse pulls by the impetus of his weight in lunges, as well as by the regular action of his muscles of ordinary progressive motion. The knowledge of these matters is not new in itself, but it may probably be new to many of those to whom the book will be most useful, and for whose benefit it appears to be specially intended.

These are the chief data from which the cost of the work to be done may be estimated beforehand, to a very considerable degree of accuracy; and the remaining portion — the maximum that can be done upon a work of given dimensions in a given time, is an element which, taken along with the quantity of matter to be carried, and the average distance, will enable the parties to make a previous calculation of the

* Published by Saunders and Otley, London.

shortest time in which the work can be completed. This may not be quite so important as the former; but still it is very important; for there have been instances in which a contractor has paid forfeit for not completing a work in a giventime, where, if the formulæ which are contained in this book had been known and understood, it would have appeared that the completion within the time specified was a physical impossibility. Any one who reflects but for a moment must see that there is a certain limit, up to which additional power employed will perform additional work; but that, beyond this, additional power can produce no effect, and thus it is cost thrown away without any useful return. Those interested are under very considerable obligations to the author for his clear and practical illustration of this point.

We would have gladly made a quotation or two from these plain and useful pages; but we really can find nothing but what would be injured by being taken out of its natural connection; and therefore we recommend the whole work for perusal. In first glancing over the pages we found some technical phrases which we thought might have been better omitted: but there is a glossary. We wish, however, the ugly word "incline" were got rid of. It is perfectly barbarous; as bad as if one were to call a living man, a "live," or the body of one who has ceased to live, a "die."

---

## BLACKFRIARS BRIDGE, &c.

When this bridge was erected, and for a good many years afterwards, it was looked upon as one of the engineering and architectural "lions" of the British metropolis,—so graceful was it in its curve, so pretty in its ornaments, and so perfectly in accordance with all that was held to be tasteful in bridge-building. Amid the admiration, two very important considerations were, however, overlooked,—the stability of the bridge itself, and the convenience of the approaches to it. With regard to the first of these, the stone was not very well chosen, neither were the blocks formed and placed quite as they ought to have been. The stone, from the very foundations, was Portland oolite, and it was not taken from a sufficient depth in the quarry. Much of it had traces of stratification; and, when the weather had got access to it, cross fissures were begun. Then the blocks were cut too thick in proportion to their other dimensions for masonry of the most substantial kind; and proper attention was not paid to the laying of them on their natural bed, which ought to be attended to in every case where there is not well established practical proof that the material is a perfect "liver-stone," subject to exactly the same action of the weather or of a water current in every position in which it can be laid. From inattention to these matters the stones splintered off in large masses, so that, in many parts, this comparatively new bridge was more dilapidated than old London-bridge, at the time when that venerable but clumsy structure was taken down. It is doubtful, too, whether the internal part was formed as it ought to have been; for, when the mania of Macadamization and mud fell upon the town as well as upon the country,—on the city as on the suburbs,—and this bridge came in for its share of the novelty, or rather of the southerly introduction of a method of road-making kidnapped from the north, where it had been in use from time immemorial—the water percolated through the joints of the arch stones, without showing signs that there was any thing that it could set or fasten in its passage. In consequence of this, there is, at least, some ground to fear that the interior of the building is tender and disunited, and that no surface repairs can ever make it a substantial bridge. The manner in which the roadway has been prepared, paved and grouted, in the executing of the late repairs, is very creditable to the parties employed, and will of course keep out the rain water for a time; and then, it may be, that the surface repairs below may retain the water until its hydrostatical pressure does extensive mischief. All the parties cannot have been ignorant that, but for the pavement, the structure was not water-tight, and, therefore, if they had contemplated a thorough and durable repair, they ought to have laid the whole upper part bare to the arch stones, and began their operations by grouting there, and so brought up the whole water-tight throughout. We do not say that this, even though done in the very best manner possible under the circumstances, would ever have made this bridge comparable to Waterloo or New London; but it would have been better than it is now. At present, we very much suspect that it has some considerable resemblance to a "whited sepulchre," in so far as "rottenness" within is concerned, though we do not suppose that it contains any "dead men's bones." But the members of corporations are often, as Sam Slick says of the bears, "calculating creturs." They know full well that, if their predecessors had done every thing, they would neither have had the civic praise for public spirit, nor civic pudding as ballast to prevent them from being capsized by the praise. Aware of this, and most laudably zealous for the honour of their successors in office, they generously so contrive matters as to leave them something to do, and get daintily praised and ballasted for the doing of it, in like manner as has been the case with themselves.

We find not much fault with this; for it is according to the general law which regulates such parties in all their public proceedings; and, besides, there is something incongruous in a short-lived creature like man even attempting to build immortal bridges, or any other material works. There is, however, one consideration, involved in the erection of any bridge or other structure which determines the situation of an important point of passage, that ought to be carefully attended to; and that is, the situation in which it is placed. In a city, or in the environs of a city, which is rapidly increasing in extent and population, this is a matter of far more importance than the mere character or quality of the structure itself. The object of such a structure, more especially if it is a bridge, whether across a river like the bridges at London, or a deep dell like those of Edinburgh, is to open up a communication with some place which, otherwise, is not easily accessible; and the result is, the founding of a new town or suburb, or the improving of the neighbourhood, on one or both sides, according to circumstances. Whichsoever of these may be the object and result in any given instance, the bridge is the centre or nucleus upon which they are formed, and according as it is right or wrong in its position, so will be all the rest.

Now, as matters stood at the time when Blackfriar-bridge was erected, the situation was, perhaps, the very worst that could have been chosen; because the ascent to it is by an ugly hill at each end; and when it was built, the only parts of the city which it directly opened upon were, Fleet-ditch and Fleet-market. At that time there was a pretty free choice of landing on the Surrey side; and thus the best landing on the city side, both for use and for ornament, ought to have been selected. Opposite St. Paul's would have been the place, both for convenience and for beauty. In those days the making of a lengthened and easy approach on the Surrey side, would have been a matter of no difficulty and little expense; and, by arching over Thames-street, the city approach might have been a level, and the cathedral would have made a splendid termination to the vista. Then, the many streets which have the neighbourhood of St. Paul's for their centre of convergence and divergence: the Strand line, the Holborn line, the Aldersgate line, and the Cheapside line. These are, and must ever remain, the grand thoroughfares of London; and to keep the termination of what ought to be the grand southern thoroughfare away from the point of their union, and land it in the abomination of Fleet-ditch, limited to the lines of Ludgate-hill and Fleet-street, was as arrant a blunder as ever was committed by the most brainless blunderer upon earth. The bridge has been placed in this untoward situation, however; the system of streets on the Surrey side has been adapted to it, and a thoroughfare is in progress by a street continued from Holborn-bridge toward Clerkenwell; so that, badly as the bridge was placed at first, it cannot now be dispensed with. The recent repairs have made it more sightly, and the improvement of the approaches and road-way more convenient, than it used to be; and, what with these, what with the extended streets northwards, the line may become a much greater thoroughfare than it has hitherto been; and thus draw more business and an improved population. But still, under any circumstances, and with any improvement that can be made, it must remain a very second-rate matter. The reason is obvious. For, granting that the thoroughfare were opened all the way to a free communication with the great north road at the Angel, at Islington, it would not be a road *to* London, but only a passage *through* it. It leads directly to no place or object of much importance;—the Fleet Prison, the Sessions House at Clerkenwell, and the House of Correction in Coldbath Fields, being the only or the chief public establishments near which it passes; and these are not the places which are most likely

to attract either pleasant or profitable vistors. As Fleet-ditch seems to have been the grand attraction which drew the bridge into its present situation, perhaps it would be better to stick to Fleet-ditch along the whole northern line, and carry the street onward to the terminus of the Birmingham Railway at Euston-square. This would, at least, have some object and meaning; whereas, at present, there is really none: the Aldersgate and St. John's-street lines being quite enough from the same neighbourhood to Islington.

The more that one observes what has been done, and reflects on what has been prevented, the more one laments the melancholy lack of *nous* which is so apparent in the matter; and, this applies not to Blackfriars-bridge only, but to four out of the six bridges, within London, Westminster, and the suburbs. London-bridge was always in the line of a thoroughfare; and since the opening of King William and Moorgate-streets, its bifurcation has made the line of it a thoroughfare of first-rate importance. So also, Westminster-bridge is in the line of a thoroughfare of considerable importance, as leading to the government offices, and the west end of the town generally; although its commercial importance is trifling compared with that of the London-bridge thoroughfare.

But, when we look at the three *new* bridges—London-bridge is only a new *edition* — what shall we say to them? They are worthy of far more extended and careful examination than we can give them in the "fag-end" of one short article; but still we must take a short glance at them; because they show that incompetent surveying is a most general, and, we fear, incorrigible, vice.

Vauxhall-bridge certainly enables one to cross the Thames at that point without the trouble of a boat; but, when we have said this, we have exhausted nearly the whole tale of its usefulness, except that it is, in the present state of things, the nearest way from the Surrey side of the river to the Penitentiary at Milbank. It is not in the line of any thoroughfare even of second-rate importance, for the roads which terminate at its abutments lead from nothing and to nothing of any importance. The best test that we can have of the value of a bridge, or any other means of thoroughfare, is, the kind of neighbourhood which it draws, and the rapidity with which this is drawn. Now, the bridge in question has been completed for some two dozen of years; and yet, no one house has yet been built on its Surrey approach; and the greater part of the road from the bridge to Pimlico on the Middlesex side is of no value, but as a laystall, — the most filthy and least profitable purpose, to which a long line of frontage towards a public road, spaciou in its own dimensions, can possibly be applied.

Waterloo, or the Strand-bridge, is certainly a fine structure; and, by many considered as the beauty of bridges, though we prefer the New London, both in its design and its masonry; as a bridge perfectly level in the road-way not only appears as a mere dead weight on the piers, without propagating any strain to the abutments, which is what gives apparent stability by making the whole structure appear one grand arch resting on land; but, notwithstanding its beauty, Waterloo-bridge is most uselessly placed. When first constructed, it must have appeared ludicrously so; for all that it connected was a few yards of street leading to the Strand, with an unseemly marsh on the opposite bank of the river. A mound was no doubt raised on the marsh, and the approach on the Surrey side was thus made tolerable easy; but we believe the proprietors have all along found that they "paid too much for their whistle." What does this gallant bridge connect now? Why, some short streets have been made in the north side of the Strand, which twine like a corkscrew as far as Covent Garden Theatre, but no farther, unless the party chooses to wheel to the right, and go to old Drury, or to the left, and regale himself with a basket of fruit in Covent Garden Market: both of these are, however, out of the line, — or rather the line stops here, and they are like a knot on the end of it. The streets that have been opened — and the length of them is so trifling that they are hardly worth naming — have attracted no trade, and no improved population; for the shops they contain are of very inferior, and sometimes of transient, character. What, then, does this splendid bridge in reality and at the pesent time connect? Why it connects the Waterloo-road with Drury-lane and Covent Garden Theatres. The Waterloo-road is one of the greatest sinks of iniquity within the vast compass of the British metropolis, far more pestilent, in a moral point of view, than the quondam marsh was, in a physical one; and we believe the only part of the population, of considerable portions of it, which lays claim to any elevation above the most degraded and degrading vice, consists of those ladies which hang about the saloons of the theatres, and whose conduct prevents the respectable part of the community from attending those places of public recreation. The driving of decent people from the theatres may be no great loss, considering the matter and manner of what is usually represented there; but it deserves notice, as a matter of wonder and regret, that the chief purpose answered by one of the finest bridges in London is that of enabling ladies of easy virtue to trip to and from the theatres during the few years that human nature can hold out against the abomination of their calling, — or if there is anything in supplement, it is that persons of depraved character, after witnessing mimic murders on the stage, may retreat easily to the dens of iniquity in this road, and there perpetrate real ones.

Now, if this bridge had been placed farther to the westward so as to be in the direct line between the Obelisk in St. George's fields and Charing-cross, it would have opened up as good a thoroughfare as most of those in the metropolis. But it seems that when a bridge or any particular structure has to be erected in the British metropolis, it is the custom of those designing it, to shut their eyes to everything else, in order, perhaps, that they may the more clearly see their own pet of the day.

3. The Southwark-bridge is another very fine structure completely spoiled by the situation in which it has been erected. On the Surrey side, the streets leading to it are all of very secondary character, and they never can become better. Then on the city side there may be said to be no outlet from the bridge at all. Thames-street, crowded as it necessarily is with drays, carts, and wagons, at all hours of the day, is the very worst place upon earth for a thoroughfare. The lower part of Queen-street is nearly in the same predicament; and, in its continuation, it leads by King-street to Guildhall, and there terminates at the most egregious libel upon architecture on the face of the whole earth.

---

## REVIEW.

### "HEATH'S PICTURESQUE ANNUAL FOR 1841." BY THOMAS ROSCOE.

CHARLES LAMB, the "gentle Charles," as he was both affectionately and affectedly styled, spoke of annuals as "ostentatious trumpery;" Welby Pugin has denounced them even rancorously; and, though he does not openly attack them, the author of "Ancient Models" leaves it very plainly to be inferred from his remarks on English art at the present day, and on Mr. Chalon, with his ladies *tirées au dernier epingle*, that he does not entertain any very great respect for the class of publications so designated — least of all for Books of Beauty, things "to be edited by Patty Prettyface, and dedicated to Prince Prettyman." Now, to say that Lamb, Pugin, and Anderson, are all arrant blockheads, is what we cannot muster up sufficient impudence to do; yet, allowing their opinions to be correct in the main, we must put in an exception in favour of some of the tribe, and express ourselves grateful for the delight we have received from Roberts' Spanish Views in the Landscape Annual — now, alas! defunct; and from similar architectural subjects by Allom.

The pencil of the last-mentioned artist has provided a rich treat for the lovers of architecture, in the present volume of the "Picturesque," which, both in regard to its illustrations and its literary portion, exhibits a decided improvement upon its predecessors — most certainly upon the last, which, though entirely devoted to Windsor Castle, showed scarcely any thing whatever of the architecture of structure, it forming only a very distant object in the landscape views; while the letter-press account of it was equally indistinct and unsatisfactory. However, the volume for 1841 has put us into good humour again with Mr. Heath and his artists. Nay, we fancy that even Mr. Pugin himself must be mollified, when he looks at some of the gorgeous and interesting specimens of his favourite Gothic, as here represented; and, though in all probability he may not care to retract so far as now to acknowledge that modern draftsmen and engravers can produce any thing to compete with

Hollar's etchings of architectural subjects, we fancy it would be very difficult for him to disprove — we will not say the competency, but the superiority, of the former, whether as regards artist-like execution or truth of representation. If Mr. Pugin really prefers the rude, coarse, hard, and wiry etchings of Hollar to the delicate and beautiful finished works of the present day, we must there leave him to the indulgence of his peculiar taste — which we certainly do not covet for ourselves; but we think even *he* must admit that the prints of his favourite Hollar do not manifest much knowledge of architectural detail, of those minute traits and touches upon which the individual character and merit of a building so greatly depends. There is certainly no pictorial charm in the dry, stiff, and frigid productions of the Hollar kind, whose value consists chiefly in their recording structures which have since perished, and thereby affording documents for the history of the art.

Mr. Allom's architectural portraitures are in a different spirit: while thoroughly conversant with architecture, he is gifted in no less degree with the painter's eye. Let his subject be what it may, whether the interior or the exterior of an edifice, or whether chiefly landscape, with buildings as mere accessories in it, he invariably treats it with a certain *con amore* feeling, and imparts to it a captivating effect. And, if there be somewhat partaking of mannerism in such effect, his manner is so agreeable in itself that we heartily wish some other people could fall into precisely the same *fault*.

In visiting Belgium, Mr. Allom found himself at home, although upon ground quite new to him, and in a country whose buildings have not obtained from the pencils of English draftsmen the notice which they merit; for, with the exception of Wild's two series of beautiful "Outlines," and Haghe's exquisite lithographs, entitled "Belgium and Germany," we know of scarcely any one else who has anticipated our able "*illustrator*," unless, indeed, it be Mr. W. H. Bartlett; but we rather imagine that the performances of the last-mentioned gentleman will be found to serve rather as a foil to those by Mr. Allom, than to decrease their novelty or interest, whenever the subjects of both happen to be the same. Of the two, no doubt Mr. Allom has been far more ably supported by his engravers; yet, making due allowance for that circumstance, it does not account for the vast difference, the drawing of the one being as feeble, loose, and indistinct — in the representation of buildings, as that of the other is characteristic and spirited. What we have chiefly to allege in the way of censure against Mr. Allom is, that he has hardly done justice to his own ability; for there are one or two subjects that were hardly worth *his* bringing home, but which might very well have been for Mr. Anybody-else; and we would gladly exchange a dozen such for a single additional plate of similar character to that which represents the magnificent old apartment in the Palace of Justice at Bruges; which, if we mistake not, is the very same of which there was such an exquisite and most covetable drawing by Haghe, at one of the water-colour exhibitions.

After that charming specimen, to which we are inclined to assign the palm, as the gem of the book, those which stand next in our favour are the Chapel of St. Gudule, Brussels; the nave of St. Gudule, with the celebrated carved pulpit; the Church of St. Bavon, at Ghent; the Church of St. Paul's, at Antwerp; and that of St. James, at Liege. These are all interior views, and, independently of their intrinsic interest — and they afford a rich treat to the lovers of architecture — are by far the best executed engravings, and also the most elaborate and clearest in their details; whereas, in some of the exterior views, the buildings are at two great a distance to show more than their style and general forms, with some slight indication of their ornamental parts. Still, admirable as the above-mentioned interiors are, they are of course only partial views, as regards the entire structures which they respectively illustrate; consequently, the interest they excite causes us to desiderate all the more complete information relative to the buildings themselves. Unfortunately, however, the author has not acted so much in concert with the artist as he ought to have done, inasmuch as he has satisfied himself with writing his tour after the usual fashion, without entering into particular notice of the subjects of the plates, except it be in regard to the pictures in the churches and other buildings here mentioned. We suspect, therefore, that however well qualified for his present task in other respects, Mr. Roscoe is not very much at home in architectural matters, but here wanted a pioneer; — and he might have found a very intelligent and useful one in the author of the "Nieerlaüdische Briefe" — a work we ourselves have lately become acquainted with, and which we can recommend, not only on account of the information it supplies relative to Gothic architecture in the Netherlands, but also for the valuable remarks it throws out in regard to that style generally.

On referring to that work, we find a most extraordinary and puzzling discrepancy between the account there given of the Church of St. Bavon, at Ghent, and that here furnished by Mr. Roscoe. According to Schnaase, the interior of that edifice is of quite modern construction, in consequence of its having been nearly destroyed by fire so recently as 1822; and most of the paintings are either quite new, or else merely copies of those which were damaged by the flames: yet there is not a syllable in Mr. Roscoe's either to inform us of the first mentioned event, or apprise us of the latter circumstance, notwithstanding that he speaks of the pictures themselves at some length, and names many artists of the present day as their authors. Neither does the discrepancy between them end here; for, while the German says that "the exterior of the church is exceedingly heavy, devoid of any of that finished gracefulness which distinguishes the ecclesiastical structures of Germany of the thirteenth century; the chapels and their gables, and the outer walls of the nave, only of brick, and the transepts without either turrets or portals. The large tower which stands insulated just before the west front is only a bare mass, with four round turrets at its angles instead of buttresses." Of the exterior generally Mr. Roscoe takes no notice; but, in regard to the tower, he tells us that it is "remarkable for its elegance, and it ascends the height of 272 feet." Now, allowing that we have here only opinion against opinion, in direct contradiction to each other, we incline to adopt that of Schnaase, because his whole book shows him to be most intimately acquainted with the continental architecture of the middle ages. But even leaving that writer out of the question, we should still demur to the opinion so briefly expressed by Mr. Roscoe, because Mr. Allom's view of the building itself — and we wonder he should have proposed it as one of the subjects for the engravings — shows it to be remarkable only for its *want* of elegance, and to justify the character given of it by Schnaase. What then could have induced the editor of the Picturesque to commit himself so very strangely? Perhaps we can give a tolerably shrewd guess, for on turning to the account of that church in the "Views of Holland and Belgium," by Mr. Bartlett, we there read, "the tower is remarkable for its elegance, and is 271 feet in height;" so that here at least we find perfect agreement, as to every syllable and letter, excepting merely the difference of a single foot in the statement of the height. Therefore it is now tolerably plain where Mr. Roscoe found out the "remarkable elegance" he discerns in the tower of St. Bavon; whereas, had he consulted with his artist, he would probably have arrived at a different estimate of the piece of architecture in question. Considered as a bit of plagiary, the matter is a mere trifle; not worth mentioning; but then it involves a most serious opinion in regard to architectural criticism; besides which, it throws suspicion upon all else the writer says, because that may not happen to be the only instance of the kind, but the whole book may abound with hap-hazard opinions of the same kind, hastily adapted from "Guides," and similar sources of information. Therefore, though we are willing to allow Mr. Roscoe has put together his materials very agreeably, so as to render this volume of the picturesque, if not exactly "standard book of travel," — as he himself says in his preface, — yet a pleasant one for those who read travels as they would do novels; we do not think him at all qualified for a task which, to be properly done, required a good deal of previous architectural study and information.

In fact the value of the book lies in the plates, not in the letter-press; and we only regret that Mr. Allom was not left more to his own taste in the selection of his subjects than he appears to have been. And even then he could have done comparatively little, considering how abundant that part of the continent is in buildings that would afford such congenial employment for his pencil. Nay, some of them would, singly, afford half a score of interesting pictures. May we not hope, therefore, that he will be induced to revisit Belgium, for the purpose of filling his portfolio with abundance of the good cheer it affords; for what he has here done is only a whet to our appetites.

Or else let him against next year visit either Munich or Berlin, of whose architecture the English public, at least the stay-at-home part of it, know nothing. It is not a little surprising, indeed, that some of our publishers of illustrated works should not have pounced upon those two capitals long before now. So let Mr. C. Heath and Mr. Allom discuss our proposition between them.

---

## ADVANTAGES OF ALGEBRA IN THE ENGINEERING PROFESSIONS.

The great advantage which a surveyor possesses over a man who merely examines an estate, a public work, or any other subject, without taking measures and making notes which can be referred to the results of those measures, consists in this, that the latter can bring with him nothing but the memory of his mere observations, vitiated by refractions, parallaxes, and all other circumstances which render the eye but an imperfect judge of figure or magnitude; whereas, the former maps down his measures with his plotting instruments, introduces such objects as give character and truth, and thus has the whole subject before him, examinable at a glance. By this means he is independent of all those causes of mistake and inaccuracy to which the eye is subject, more especially when the observer proceeds by lines having flexures, and has to pass over an extent of surface of which the eye can command only a small portion at any single view.

Any one may convince himself of the truth of this, by walking along the bank of a winding brook or river, in such a manner as that he has very little view either backwards or forwards. Even though the sun is shining, unless he has had great practice in this kind of observation, he will be firmly convinced in his own mind that he has been walking along pretty nearly in a straight line, although, in reality, he shall have moved in succession to every point of the compass. Not only this; for, if the loops are deep and numerous, if a cloud comes over the sun, and, sometimes, whether that occurs or not, his mental compass will get reversed, so that he shall firmly believe that the north is the south, and the east the west. Nay more, he will actually believe that the current of the river has reversed, and that he is on the wrong side, and going the wrong way; and, in pathless countries, during cloudy weather, a man has often walked vigourously the live-long day, in order to get at a distant point, and, after all, landed at night just where he set out in the morning. Of this, there have been so many instances, in the cases of intelligent parties, in full and perfect possession of their senses, that it must be received as an incontrovertible truth.

It clearly shows us the great benefit which is derived from measuring, and planning and mapping; in fact, it shows us that, without these means, we should have very vague knowledge of length and direction, and of form and magnitude.

This is in strict accordance with the nature of the eye as a mere organ of sensation, and with those mental faculties, or rather that mind, by means of which we make comparisons and draw conclusions, and so prepare ourselves for acting according to knowledge, and, therefore, acting aright; that the eye sees nothing but colour, without having in itself the slightest knowledge of the form or magnitude of the coloured object, or even of the existence of such an object, is a truth which cannot be too often inculcated; and this not to serve any metaphysical purpose; but simply to prevent us from being led into error by our eyes, when we are seeking that accurate knowledge of form and magnitude which is necessary for every body, but more especially for those of the engineering professions. If the eye could see of its own immediate perception, and without the aid of any process of thought, that there is a rectilineal triangle, it would, at the same time, see that the three angles of that triangle were equal to two right angles; and the whole science of geometry, plane and solid, would be matter of mere sensation; and all animals who have eyes would understand it as well as man; indeed, some of them would understand it much better, for their vision as a sense is more acute than his.

We see colour; that is, a certain modification of the action of light proceeding from an object produces a certain sensation in the eye; but, when the object is removed, the darkness of night upon it, or the eye closed, or turned in a different direction, the impression is gone, never to return as a mere sensation; and, were it not from the mental comparison, and the inference drawn from that comparison, of similarity or dissimilarity in the sensations, we should have no knowledge of colours or the distinction of one colour from another.

When we come to form and magnitude, the process is more exclusively mental; and, in as far as sensation is concerned, it is quite different from mere sight. We know nothing about length, though the simplest of all magnitudes, until we measure it. Muscular action is our natural instrument of measure; but it carries us only a little way, and that in a most uncertain and imperfect manner. The muscles which move the eyeball in its socket may, indeed, be trained, by experience, to measure short distances with a tolerable degree of accuracy; and this is an education of the eye which every one who aspires to the engineering professions should acquire of himself with the utmost diligence; for it is one which nobody else can teach him. While we are upon this part of the subject, we may add that there are hundreds of little branches of education, both of the body and of the mind, which are of every-day necessity in these professions, as well as in most others, and which no book can explain, and no master can teach. This, by the way, is one of the strongest arguments in favour of the practice of an apprenticeship in supplement to even the best scholastic education, before a young man is qualified to take any one of those professions upon himself.

All these little educational *morceaux* are good as far as they go; but that is only a little way; and then recourse must be had to those instruments in which there is no deceit, save what arises from faults in the construction and the using. There is nothing which proves more clearly the advantages of actual measurement and geometrical delineation, over mere sights and drawings made after the eye, than the remarkable difference which there is between the real form of a subject and its perspective representation, when that representation is as true to the eye as it can be possibly made; and, notwithstanding this, it must be borne in mind that the understanding and belief go along with the geometrical form, and not with the perspective or visual representation. Thus, for instance, the perspective representation of a circle is never a geometrical circle unless when the eye is perpendicularly opposite to the centre of it; and yet, if we look ever so obliquely at any circular object, such as the lip of a cup, we never have the slightest impression that it is an elliptical one; and so, also, if we take an elliptical cup and look at it in that peculiar position in which the perspective representation of its lip would be a geometrical circle, we do not, on that account, believe that it is a circle.

Another illustration may be drawn from the interior of an apartment which is a rectangular parallelopiped, or has all its opposite sides equal and parallel, and all its angles right angles. If we stand against the middle of one end of such an apartment, and look toward the opposite end — the eye being exactly midway between the floor and the roof, the visual or perspective form of the interior, so far as it is seen, is any thing but a parallelopiped;—it is a frustrum of a rectangular pyramid, whose length is the width of the room, whose breadth is the height, and whose altitude or access is considerably fore-shortened, that is, shorter than the actual measure from the nearest visible part to the opposite wall: more than this, we may imagine the angles made by the roof and floor of the side walls to extend in straight lines to the point directly opposite to the eye, and then we have a visual or perspective view of the whole pyramid onward to its apex, the distance of which is, in reality, indefinitely great, and would reach to the remotest star, and farther beyond that than can be arithmetically expressed. But what is our mental perception and belief of the apartment all the time? Is it that of a pyramid or even of frustrum? No such thing: our feeling and belief are, that the visible portion of the apartment is perfectly

rectangular; and, if we have been accustomed to accurate observation, our eye, or, to speak more correctly, the inference which the eye draws from what the eye sees, will detect a very small deviation from the parallelism of the opposite surfaces, or from the equality of the angles.

Many other illustrations might be given, all tending to prove that, in matters of form and magnitude, what we actually see and what we really believe are very different from each other. One shall, for example, stand on one edge of a large park or common surrounded by trees of equal height; and be under the shade of one which rears its splendid volume fifty or a hundred feet above one's head, and yet the trees on the opposite side may, in consequence of their distance, be visually or perspectively lower than the fern or the grass which is at one's feet. But, notwithstanding that they thus appear dwarfed to the eye, they are just as gigantic to the understanding and the belief as those under whose shade the observer has taken his station.

It would be needless to multiply illustrations, because the fact is universal. Architects and others engaged in the construction of works, especially in works wherein beauty and utility go hand in hand — as they should do in every public structure, and as much as possible in every private one, are perfectly aware of this; and, being so aware, they produce two sorts of representations of the structure to be erected. One of these is a perspective representation of the intended work, as it shall appear to the eye when finished; and this is meant for those who are incapable of putting together, generalizing, and comprehending the united effect of that which shall result from the other kind of representations. These representations are plans, elevations, and sections, which are understood to be at right angles to each other, and to give, accurately drawn to a scale, the real geometrical dimensions or admeasurements of the whole structure, and also of all its parts. They are, in fact, geometrical dissections of a general conception, which must have existed in the mind of the contriver of the work before they could possibly have been executed; and the real object of them is to enable the practical overseers and workmen to carry the work into execution in strict accordance with the original plan of its designer.

From this it will be seen that the designer of such a work, whether it belong to what is called the architectural, or what is called the engineering, department of the profession — and the line of distinction between these is, in many cases, obscure and difficult to be drawn; — from this it will be seen that the engineer or the architect has both a synthetical and an analytical operation to perform in his own mind, before he is in a condition for producing either the representations which are to make the public, or the parties who employ him, understand it, or those which are to guide the artificers in the carrying of it into execution. In this mental synthesis and analysis, if the work is to be an original one, and not a servile copy of something pre-existent — and every great work, even though it belong to a well-known style, should be in so far original, because that which suits best in one situation cannot by possibility suit best in a situation which is different. Now, in these mental operations there are many matters of importance which cannot, in the nature of things, be represented in plans of any description, or embodied in words, so as to be intelligible even to the party himself. In this, the highest and most valuable part of his art, and almost the only one in which he can have real merit, the architect or the engineer must therefore put pictorial representation and common language clean away from him, and work by the sheer effort of his own free and untrammelled intellect. We admit that this is a height to which none but the very foremost men in the profession can climb; but, once attained, there is glory in it to themselves above all gain, and delight to the public, which makes them disregard all expense; and therefore the attainment of it ought to be the chief and continual ambition of every man who dares to enter those professions.

With the surveyor the case is different. He has not to combine and invent, but merely to represent matters as he finds them, in the most faithful, clear, and accurate manner, so that they who come after him, and turn those matters to account, may thoroughly understand that with which they have to deal. In this, however, more is required than is generally done or even supposed, because this is the foundation of the whole; and, if the foundation is not firmly laid, the structure can neither be seemly nor stable. Accordingly, though we do find occasional instances of blundering and bad taste, both in architecture and in engineering, considered in themselves, and arising from incapacity or indifference on the part of those who directly follow those professions; the grand cause of most of the imperfections which we see may invariably be traced to the want of proper surveying — to ignorance of those circumstances which, if properly known, would have enabled the architect or the engineer to adapt his work to the place and the purpose required, and render it part of one harmonious whole, instead of being an excrescence and an eyesore, as it sometimes is.

But granting that all this preliminary knowledge is obtained in the best and most accurate manner; the architect or the engineer has to do something more and greater than can be furnished to him by the very best data which surveying can afford him. These data, however correct they may be, are still only scattered elements; and it is his business to combine them into a whole which shall be as useful, as elegant, and as cheaply executed, as possible. This demands not only a range of mind, but a power of generalization, and a faculty of discerning all the relations of many parts, which are not required by men of any other profession; and the question is what is the preparation which shall qualify him for exercising those high talents most effectually and in the shortest time. The knowledge which he obtains, whether from his own observations and surveys, or from those of others, and whether represented in plans, or expressed and described in words, are merely the materials upon which he has to work; and these materials he must combine together in his own mind, and clearly see the end from the beginning before he advances even a single step towards the construction of the plan of his work. It is true that there are, or at least there have been, those who blunder on by something like what is not inappropriately termed "the rule of false." They contrive, or they borrow from the contrivances of their predecessors, a something; and they compare this something with the circumstances of the case in hand, after which they keep botching and altering at it to try and make it fit the circumstances — much in the same way as a young bear or an act of parliament is said to be licked into shape.

In these cases, "the licking" may be all very well, though we dare say the bear would come into shape without it. In the other case which we have taken in illustration it is indispensable; for there is no getting at all the data upon which a legislative enactment should be grounded; and thus the easiest way is to let the data alone, make the enactment, and then alter it till it will something like do. The difficulty consists in the principal element — human society — being perfectly indefinite, and not accurately expressible either by the figures of arithmetic or the figures of intelligible speech. With an architect or an engineer this is not the case. In the contrivances — we may say the enactings if not enactments of these — the data are, with trifling exceptions on the part of the engineer, all determinate, and may be determined either directly by surveying, or analogically from the data which the surveyor furnishes. Therefore, if the "rule of false" is resorted to in the planning of any public building or other public work, the party who resorts to it is, for the time at least, no architect or engineer, but merely an impostor assuming the name. If that name is his in reality he will come duly feathered with knowledge, and fly straight to his work like an eagle or an arrow.

That he may do this readily and unerringly, he must undergo a species of mental discipline which few other men require. Before he enters on his profession at all he should be habituated to form combinations upon sound and well established principles, and in such a manner that the whole, and all the parts, and all the relative bearings, should be seen at a single glance. Now, we know of but one species of mental discipline which can give him exercise in this way, so as to mature his faculties for the certain and speedy attainment of real greatness, and that is thorough practice in the science of ALGEBRA. We of course do not mean the algebra of the common schools — the mere performing of operations and solving of equations, according to rules which are not explained and understood, and which are therefore merely empirical to the student. This is not *Algebra:* it is merely common arithmetic disguised by a different form of notation — a supplemental arithmetic as it were, which is annoying enough certainly, but not in the least useful. We remember fagging at this description of algebra for a short time, and wishing it fathoms deep under the ocean, for we could not obtain a single ray of light upon it, any more than if we had been

lampless in the deepest coal mine. Chance, however, brought Leonard Euler's "Elements" into our hands, and all was light. The book is so simple, yet so profound, and so beautifully searching in its analysis, that any one who does not, after one careful reading, thoroughly understand the science of which it treats, ought to be birched from Dan to Beersheba as an incorrigible dunce.

The science, which is so thoroughly embodied and so luminously set forth in that invaluable work is to the intellect what the plan of the surveyor is to the eye. It is the map of thought, not confined to measure, to number, or to weight, but equally applicable to all quantities determinate and indeterminate, real and imaginary, and to all the possible relations in which they can stand to each other. Now, it is not things or quantities themselves, but the relations which they bear to each other, which are the stumbling blocks in the paths of the blind engineer. It is by these relations that he works, in the adapting of his elements to each other, so as to form a whole which shall be the very best suited for the intended purpose. Therefore, though he should possess all the knowledge of physics and chemistry, all the dexterity of hand, and have experience to boot; yet, if he lacks the power of mental analysis, that power which there appears to be no getting at without Algebra, or a more laborious mental discipline, which a man *may* acquire without knowing how, he is more indebted to good fortune than to merit, if he is not consigned to a low form in the engineering class. Therefore, we would say to every youth aspiring to the engineering professions, "Study Algebra, and study it thoroughly."

---

## PROGRESS OF MANUFACTURING ARTS ABROAD, AS REGARDS MACHINERY.

Machinery is the main agent of manufactures, and no surer index of the progress of the latter can be adduced than the advances of the former. I am, I confess, not among the number of those who magnify the relative importance of the existing circumstances and extent of foreign competition; but I should be wilfully blind to the plainest evidences of the truth, were I to conceal that there are symptoms throughout the continent of a prospective, and by no means a remote, rivalry with this country in the chief of those arts of production and elements of commerce in which England has heretofore maintained a perfect and facile pre-eminence. The peril to this country is to be measured not by the present competition, but by the magnitude of the preparations, and the germs of a progress which is as yet confined to a promising and vigorous infancy, evidenced chiefly by the rapid increase of machine-making establishments, to a slight description of which I shall devote this chapter.

Belgium, from her mineral riches and other topographical facilities, naturally takes the lead to the progress of continental machinery. I have already alluded to the leviathan establishment of Mr. John Cockerill, at Seraing, employing 3000 workmen, with seven skilful English engineers superintending the chief departments, and combining English skill with the advantages of cheap labour. The motive power consists of steam-engines of 900-horse power; and Mr. Cockerill not only supplies machinery to all parts of the continent, but has branch establishments in three different countries. In addition to spinning machinery of every description, steam-engines, both stationary and locomotive, are supplied to France, Germany, and Russia. It is difficult to name any large enterprise of manufacturing industry, whether in Belgium, Holland, Russia, or the immense territories of the Prussian league, with which Mr. Cockerill is unconnected, either as a shareholder, or as the engineer from whom the machinery emanates. He has spinning mills of flax, or cotton, or wool, in almost all the chief districts for these manufactures, in the Prussian or Belgian dominions. Mr. Cockerill's name is on all the locomotive engines on the Belgian railroads, and I was told that he is the contractor for those now forming in Russia.

When we remember that Mr. Cockerill's father, who established this gigantic concern, came over to Belgium a common blacksmith, and could neither write nor read, I believe, till the day of his death; when we farther consider that the machinery he turns out is, after all, of secondary reputation for quality, and extremely dear, we may form some idea of the power and magnitude of the natural advantages Belgium affords for the manufacture of machinery, and which may be reckoned as the multiplier of all her other productive powers. Mr. Cockerill, extensive as are his enterprises, by no means monopolizes the making of machinery. Of those now commencing, there are the Messrs. Fairburn, who have issued prospectuses of an establishment, which was to be formed at the large factory already built at Malines, near the railroad station. Mr. William Fairburn is to superintend the heavy department for engines, locomotives, &c., and Mr. Peter Fairburn that for the spinning machinery, and especially for flax spinning. There can be no question that this establishment will rival any in England. In addition to these is the Company of the Phenix at Gand, on a very large scale, and in which English and Scotch engineers are already engaged. There is likewise another at *anonymes*, of which the Banque Nationale is said to be at the head. 500 workmen, of nearly all nations except France, whose operatives are not in repute in Belgium, are employed. Some of Sharp and Robert's machinery was there. The present motive power is not above 36-horse.

There are several old established machine-makers in different towns in Belgium, but few on the same scale as those I have named. The fact is, that this industry is yet in the first stage only of its development. Mr. Cockerill told Sir Hamilton Seymour that he had all the new inventions over at Seraing ten days after they came out in England.

There is but one chance of an obstacle to the career of Belgium in her manufacturing progress of competition with England, and that one her Majesty's Government have recently, no doubt with the best intentions, used their best exertions to remove, exertions which have met with the best reception and success on the part of Belgium. I allude to the decreasing stock and increasing price of coal in that country. The following table of its rapid rise in price is extracted from statistical government returns.

| | | |
|---|---|---|
| 1836.—Mons ..... | 7 and 8 fr. | per tonne. |
| Charleroi ..... | 13 and 14 fr. | id. |
| 1837.—Mons ..... | 12 and 14 fr. | id. |
| Charleroi ..... | 18 and 19 fr. | id. |

Prior to 1836, Mons coal was 8 fr. per tonne at the *maximum*. It has risen again in price since last year; and the Belgian government have consequently assented to the prayer of the English government, to be allowed to supply them free of duty.

By France a similar *boon* has been granted to the coal owners in England, and I need hardly say that the Belgian and French manufacturers are overjoyed at the concession.

The iron-works have made equal progress in Belgium. In 1837 there were 23 high furnaces of coke, and 66 of charcoal, in Belgium; 20 new furnaces of coke are either completed or being erected since that period. On the plain of Selessin, near Liege, a Company are erecting six of a colossal magnitude, which, when finished, will be the largest on the continent. The quantity of iron founded in the year in Belgium was estimated at 150,000 tonnes (or about 147,640 English tons.) It is now increased. The following are the current prices of iron per *tonne*.

| | 1st Quality. | 2nd Quality. |
|---|---|---|
| 1830 ..... | 465 fr. | 390 fr. |
| 1832 ..... | 412 fr. | 322 fr. |
| 1834 ..... | 393 fr. | 304 fr. |
| 1836 ..... | 413 fr. | 324 fr. |

In France, machine-making is proceeding with considerable rapidity. Mr. Dyer, of Manchester, has established his son at Blangy, not far from Abbeville, and there are many French competitors. There is one especially at Rheims, who turns out excellent machinery, and many at St. Etienne.

At Zurich, in Switzerland, there is a first-rate establishment of this sort, where iron steam-boats, down to the finest spinning machinery, are manufactured. There are nearly 700 workmen employed here, and 7 are English foremen. Mr. Escher, who is one of the first and most scientific industrialists of the continent, is at the head of this establishment, and, like Mr. Cockerill, is also the proprietor of several flourishing steam-factories, some paper-mills, and some weaving and some spinning mills, not only in Switzerland, but in Piedmont, Savoy, the Tyrol, and Wirtemburg, where he is about to erect a flax factory. Mr. Peter Kennedy, late of Manchester, is in partnership with him, and superintends the Austrian mills. New inventions are frequently made. For instance, I saw a roller introduced at the end of the carding-frames, round which the cards are wound, and which dispenses entirely with the pans, and consequently with a great number of hands still employed in most, if not in all, of the English mills. Again they are enabled to unite the separate advantages of different patents in England; and at Mr. Escher's factory in Zurich I saw a combination of the self-acting mules severally produced by Sharp and Roberts, and Mr. Smith of Deanston, and which their patents prevent our combining in England.

Many of the foreign mechanics, who have not an equal skill in the invention or improvements of machinery, directly pirate the productions of English skill. An English gentleman told me he had assisted in putting together some new machinery in Italy, which had been cast in moulds, formed from some smuggled machinery of the Messrs. Crichton, with their name and the word patent cast on it.

At Vienna the emperor has a large establishment under his immedi-

ate patronage, and an Englishman, of the name of Thomson is one of his chief superintendents. The emperor of Russia has very large foundries and spinning factories at Alexanderoffsky, with a General Clark at the head of the foundry, and a Mr. Wilson of the factories, and at Colpenny with several English workmen. Wilson, brother of the above-named, is the foreman or superintendent at St. Petersburg; the foundry is chiefly for cannon. John Isherwood, formerly of Leeds, is at the head of another establishment, called Waybugskey, a part of the capital.

The following information on the denizen mechanical skill in Poland is from a perfectly authentic source. A large mill, having sixteen pair of mill-stones, moved by steam-power, and lighted with gas, was erected at Warsaw some years ago. It was at first managed by a native of France, under whose management it did not succeed. For the last six years, a Mr. Kedslie, mill-factor, from Leith, has been the superintendent, and he has taken out two millers and their families from the mills on the water of Leith; the mill is now working day and night, and succeeding well. All parties concerned there are said to be much pleased that the bill to grind bonded corn has been thrown out by the British House of Commons. They fear nothing so much as British capital, machinery, and skill, to compete with them. John Douglas and nephew, from Edinburgh, established thrashing-machines and paper-mills in Poland, and have settled as paper-mill proprietors in that country. Since the last rebellion in Poland, James Garvie and son, also Thomas Garvie, silk manufacturers, from Edinburgh, have succeeded in establishing a shawl manufactory, thirty miles from Warsaw, upon the estate of Count Lubenski, President of the Board of Trade there; the factory consisted of 30 looms in the month of September, 1836. This same count has erected a spinning mill for flax, 300 feet long, 100 feet wide, 3 flats in height, and has 200 looms at work, weaving table-cloths, towelling, and linens; also thirty shawl looms, in the month of September, 1836. The yarn all spun by his own mill. Thomas Garvie has engaged to be his overseer for the weaving department, and left the shawl factory to his brother James and son, who are doing well.

Mr. Pritchard, from Edinburgh, now engineer to the Government zinc mines in Poland, was in Scotland two years ago, at which time he engaged a bleacher from Perthshire, who has commenced bleaching to the above establishment. This is the first attempt at bleaching in Poland.

Mr. George Blackie, engineer, from Edinburgh, is now employed on canals and public roads by the government of Poland.

At Prussian Bohemia, at Aiz in Prussia, and in Saxony at Chemnitz, there are also machine-making establishments. In fact, they are rising in all parts of the continent with a rapidity, and to an extent, very far disproportioned either to the growth of the population or to the progress of preceding years.—*Symons' Report.*

---

## THE ARCHITECTURAL SOCIETY.

This association had a *conversatione* on the 3rd ult., at its rooms in Lincoln's Inn Fields, and drew together on the occasion a very crowded attendance of its members and its visitors. Many original drawings, lithographic plates, and engravings of objects interesting to the student and general admirer of the art and science, which find here a very unostentatious fame, were arranged about for inspection, instruction, and gratification. The chief feature, however, in the proceedings of the meeting was a lecture, delivered by Mr. Tite, on the subject of bitumen as an architectural agent. This was indeed a very carefully prepared disquisition, in which a nice analysis of that remarkable substance was minutely entered upon; its various qualities, as found in different parts of the globe, distinguished; and its application in both ancient and modern times, as an effective cement, exposed with much discrimination and historic detail. Many specimens of the material were displayed in illustration of the lecturer's views. He dwelt with considerable approbation upon the useful qualities of bitumen in the construction of tanks, of subterraneous arches, and as a *prophylactic* in all cases against the insidious operations of damp. More than a century ago a treatise was written and published in France, commending it for all the good qualities now recognised as peculiar to it in the hands of the skilful architect. From this Mr. Tite read some emphatic passages, to the correctness of which he gave the sanction of his own experience. The meeting seemed much gratified with the lesson, and indicated as much by the applause at the conclusion of the lecture.

---

## INSTITUTION OF CIVIL ENGINEERS.

*Continued from page* 238.

*April* 14, 1840.—"Description of the Steam Ship 'India,' with a table of the proportions of large Steam Ships." By Lieutenant E. N. Kendall, R. M., Assoc. Inst. C. E.

This vessel was built at Greenock by Messrs. John Scott and Sons, and the engines were constructed by Messrs. Scott, Sinclair, and Co. To render her eligible as a packet ship between London and Calcutta, *via* the Cape of Good Hope, the timbers where lengthened so as to admit of the quarter deck and forecastle being raised 2 feet more than is usual; by which means a flush deck was formed along the whole length of the vessel, 200 feet by 29 feet, materially adding to the comfort and convenience of the passengers. The long flat floor, with straight sides and fine ends, adopted in all the best of the Clyde-built ships, for the purpose of attaining a considerable speed with comparatively small power, and uniting with a light draft of water a good capacity for cargo or passengers, has been adhered to, although the established usage on the Clyde of making the length six times the beam has been somewhat exceeded, without impairing the speed, as the voyage from Greenock to London was made in 86 hours, against a strong head wind during a considerable portion of the time. The rigging is fitted so as to combine lightness with strength, and the facility of making every thing "snug" when steaming against the wind; the spars being so proportioned as to carry a large spread of canvass when running down the trade winds. There are several improvements in the rigging. Two of them are particularly mentioned. 1st. The employment of iron sockets, into which the shrouds, having been tapered, parcelled, and served, are inserted and firmly rivetted. Instead of passing over the mast-head, they are attached by shackles to a series of holes along the edge of a strong wrought-iron plate or cap which surrounds the mast. This is more secure than the ordinary fastening, as it prevents all chafing or injury from the wet, besides being more compact, and allows any repairs to be more easily effected. 2nd. The mode of fitting the fore-yard for coming down readily in bad weather. The truss bow is made sufficiently large to admit of the heel of the fore-top-mast passing readily through it, and has on its fore-end an eye through which passes an iron bolt 5 feet long, which is held in its position by a chain passing round the mast-head; to the lower end of the bolt is attached a chain, which passes through a swivel eye on the yard, and is drawn tight by a screw traversing one of the deck-beams. When the yard is hoisted up, it slides along the chain jackstay, which prevents it from swaying about until it reaches the bolt which enters the swivel eye, and when it is close up, the yard is slung by two short chains shackled on to the mast-head chains. The operations of striking the yard and top-mast may be thus accomplished simultaneously in a few minutes in the worst weather, or they may be replaced in the same short period.

The engines have most of the acknowledged improvements, and are fitted with "Hall's Condensers" in such a manner that they can work with them or with the ordinary condensers. The cylinders are 62 inches in diameter, with 5 feet 9 inches stroke. The diameter of the paddle wheels is 26 feet; the length of the floats is 8 feet, divided into two parts in the depth, and fixed one before and the other behind the arms. There is an apparatus for cutting off the steam at any portion of the stroke. The boilers are of a peculiar construction, combining vertical flues with a series of horizontal fire tubes, exposing a very considerable surface so as to be worked by slow combustion of the fuel from two sets of fire-places over each other; by throwing on the coals alternately, the gas evolved from the fresh fuel is ignited in its passage over the other fire-places. A considerable economy has been effected by these means.

"Description of a Dynamometer, or an Instrument for measuring the Friction on Roads, Railways, Canals, &c." By Henry Carr, Grad. Inst., C. E.

The object of Mr. Carr's modification of the dynamometer is to obviate the irregularity of the common indicator arm, caused by the jerking motion of the tractive power or any inequality of resistance. The instrument consists of a cylinder half filled with mercury, and containing a piston connected with the spring of the dynamometer, so as to be lowered or raised as the tractive power is increased or diminished. Two tubes of glass, connected by a passage with a regulating valve, stand in front of the cylinder, one of them communicating freely with it, and in this tube the mercury is raised or lowered proportionally to the power applied; while, in the other, an average of the variations is obtained as the facility of communication between the tubes is increased or diminished by the opening or closing of the stop-valve. The instrument must be graduated by actual experiment, and the results of the average power may be read off from the scales placed behind the tubes. The paper is illustrated by a detailed drawing of the machine.

"An Account of a proposed Suspension Bridge over the Haslar Lake at Portsmouth." By Andrew Burn, Jun., Grad. Inst. C. E.

The usual calculation for the maximum load on each superficial foot of the platforms of suspension bridges is 70 lbs.; but, as in the event of a crowd of persons assembling, the pressure may increase to nearly 100 lbs. per foot, and by the passage of soldiers marching in regular time, the strain may be greatly augmented, the projector assumed 200 lbs. per superficial foot as the amount of load to which the platform might be subjected. The peculiar feature of this bridge is the substitution of cast-iron chains for the wrought-iron ones generally used. This deviation from the usual practice is adopted as a measure of economy, and with a view of increasing their stability and durability, cast iron being much less influenced by atmospheric action than wrought iron. Cast iron beams, when well-proportioned, will bear a very considerable tensile strain. As these chains would be proved beyond the weight they are intended to bear, no doubt is entertained by the author of their security. The platform, which is formed of transverse iron girders carrying cast-iron plates ¼ of an inch thick, with dovetails falling into holes cast in the girders, is suspended by wrought-iron rods 1½ inch square, from two lines of chain only, as the strain is more easily brought to bear on them than on a greater number of chains. They are trussed laterally to prevent oscillation, and the balustrade is so constructed as to prevent the undulation so prejudicial to suspension bridges generally. To insure a perfect bearing, each pair of links of the chains are, in manufacturing, cramped together, and the holes bored out to receive the pins, which are turned to fit them accurately; they are of a larger size than usual, being 4 inches diameter, and a less number are employed. The piers on which the chains pass are of cast iron, 33 feet high above the level of the roadway.

| | Feet. |
|---|---|
| The extreme length of the bridge is | 632 |
| The breadth of the roadway | 17½ |
| The clear waterway between the piers | 300 |
| The clear headway of the platform above the high water line | 18½ |
| Ditto ditto above low water line | 33 |

The tension on the chains is calculated as equal to 991·4143 tons. To sustain this tension, the section of the chain is 256 square inches, and taking 7 tons per square inch as the elastic limit of cast iron, the resistance of the chains will equal 1792 tons, leaving a surplus of 800·6 tons after the calculated strain has been deducted from the real strength of the chain. Three elaborate detailed drawings accompany this paper.

Mr. Smith, of Deenston, explained a new system of lockage for canals proposed by him, a model of which he presented to the institution. To avoid the present expensive construction of locks and their waste of water, the author proposes to divide the canal into a series of basins, the water levels of which should be from 12 to 18 inches above each other. The extremity of each basin is so contracted as to permit only the free passage of a boat; in this is placed a single gate, hinged to a sill across the bottom, the head pointing at a given angle against the stream, and the lateral faces pressing against rabbets in the masonry. The gate is to be constructed of buoyant materials, or made hollow so as to float and be held up by the pressure of the water in the higher level; on the top is a roller to facilitate the passage of the boats. When a boat is required to pass from a higher to a lower level, the bow end, which must be armed with an inclined projection, depresses the gate as much as the depth of the immersion of the boat, and as much water escapes as can pass between its sides and the walls of the contracted part of the basin. The same action takes place in ascending, except that a certain amount of power must be expended to enable the boat to surmount the difference of level between the basins. The quantity of water wasted by each boat would be in proportion to its immersion and the speed at which it passed over the gate. In case of different sized boats passing along the same canal, it is proposed to have a small gate forming part of the main gate, so as to avoid the loss of water which would ensue from the whole width being open for the passage of a small boat.

*May 5*, 1840.—"Description of the engines on board the iron steam tug, the Alice." By J. Patrick, Inst. C. E.

The speed of this boat having far exceeded the constructor's expectations, induced the author to send a description of her proportions, and of the construction of the engines. The chief peculiarity in the engines is, their being placed in the centre of the vessel, with the two cylinders in a line with the keel, and placed at an angle of 45°, inclining inwards towards the paddle shaft, to which the motion is communicated direct (without the use of side beams) by long connecting rods attached to the cross heads, which are placed at the lower ends of the cylinders, instead of being on the top as in the usual manner; the connecting rods are thus enabled to be three times instead of twice the length of the stroke, as is usually the case. The framing is entirely of wrought iron, on the tension principle, and appears to resist the tendency to vibration better than cast-iron framing. For the two cylinders of 31 inches diameter, there is only one air-pump of 22½ inches diameter, with 19½ inches length of stroke, instead of the usual complements of two air-pumps, 18 inches diameter each; this is found to be sufficient, as a vacuum of 13½ lbs. per square inch is maintained. One of the advantages proposed by this mode of construction is the reduction of weight; these engines only weighing 9 cwt. per horse power. The small space occupied leaving more room for passengers, they are particularly adapted for river navigation, where the breadth of beam must be limited. The simplicity of their construction renders them less liable to expensive repairs.

The principal proportions of the Alice are —

| | Feet. | Inches. |
|---|---|---|
| Length between perpendiculars | 95 | 0 |
| Breadth of beam | 20 | 0 |
| Draft of water | 4 | 6 |
| Diameter of wheel | 14 | 0 |
| Size of engines | two 30-horse power | |
| Diameter of cylinder | 31 inches | |
| Length of stroke | 3 ft. 3 in. | |

The engines were constructed by Messrs. Davenport and Grindrod, of Liverpool. Drawings of the boat and engines accompany this communication.

## RECORD OF PUBLIC WORKS.

South-Eastern Railway.—This great undertaking is now proceeding with the utmost vigour; all the works between Tunbridge and Redhill are in a state of great forwardness, it being the intention of the Directors to open the line as far as Tunbridge with the least possible delay. The tunnel near the village of Bletchingly, which is a particularly arduous and heavy structure, is also progressing considerably. This is one of the most interesting works upon the line, particularly to the geologist, as it passes under ground near the foot of Tilburston-hill, which it is well known has been subjected to some powerful subterraneous action, the strata upon some parts of the hill being singularly distorted. All the phenomena observed by the engineer, in the progress of the work, show this spot to have been peculiarly subjected to the upheaving and disturbing powers which at some remote period have been in active operation. Mr. Simms, the engineer, who resides at Bletchingly, is in possession of several interesting fossils, which he has found in the progress of his work.

Great Western Railway.—So determined are the efforts to get this line opened before the middle of December, that on one part, for which Mr. Bedborough is the contractor, the excavations are, for expedition, carried on upon a novel and undoubtedly quick system. A-during the past week, the wet has so obstructed the horse and barrow runs, platforms are erected one over the other, and the soil is thus thrown up, a spitful at a time with the spade, and then successively hoisted to the next, where another man is ready to receive and pass it on.

Plymouth and Exeter Railway.—Mr. Rendel in his elaborate report proposes that the terminus in Exeter should be at the south of St. Thomas's church, from whence the railroad is to run by the Perridge or Ide valley, reaching the high ground beyond it by an inclined plane. It thence passes to Dunsford, and, reaching the valley of the Teign, runs up that valley, near Moreton-hampstead on the one hand, and Drewsteignton on the other, and, passing close to Chagford, reaches the valley of the North Bovey river. Having traversed this valley, it ascends to the New House pass, on Dartmoor, (on the turnpike-road from Moreton-hampstead to Tavistock, and about six miles from the former town,) by an inclined plane. The line now passes for eight miles across the forest, "principally through valleys comparatively sheltered, and presenting the most imposing scenery." It passes near Vitafor mine, and down the valley, enters the Runnidge valley, near the farm house of that name. It then sweeps round to the south of Merripet estate, and thence to near Post Bridge, where it crosses the east Dart. It here traverses the valley running near the Tavistock and Moreton road, and reaches the Cherrybrook valley, at the bridge on that road. Hence it passes through Prince Hall estate, crosses the west Dart, and into the valley of the Swincombe river. It proceeds up this valley to White-works mine, and quits the forest by the Nun's Cross pass. It now passes by Sheepstor bridge to Meavey, and thence reaches the valley of the Plym. By a deep cutting it crosses the Tavistock road to Jump, and passing near Manadon, to the west of Knackersknowle, crosses the Devonport, and, running down the Houndscombe valley, reaches Pennycomequick, from whence, in three branches, it can be

carried to such parts of the towns of Plymouth, Devonport, and Stonehouse, as may be deemed most eligible.—This proposed plan is 42¾ miles in length. The rivers Teign and Plym hold their course in the direction of this line, and their valleys are rendered available. The lower portions of these valleys will admit of gradients, which, though heavy in comparison with those found in many of the great existing lines of railway, are ascertained by late experience to be worked easily and inexpensively. Over the forest itself, also, a good workable locomotive line is obtained; it is therefore only in the two intervals of the line which lie between the Dartmoor and the two end locomotive portions that we find a necessity for deep gradients, or inclined planes, requiring stationary power. To provide a sufficient amount of steam power for the passage of trains, with the requisite speed, over a great length of such inclined planes, would involve a very considerable outlay and yearly expense; but, owing to the superabundance of water power, readily convertible for this purpose, the difficulty may be overcome, and the plan rendered simple and inexpensive. Of the 42¾ miles, the length of the line, only 42 miles are through enclosed and cultivated country; the remainder, which is the most beautiful part, passes through rocky glens, with patches of wood and pasture. The forest of Dartmoor, and the whole of these lands, are held by a very few proprietors, the principal of whom are Her Majesty, in right of the Duchy of Cornwall; the Right Honourable the Earl of Devon, Sir Ralph Lopez, Bart., and John Ponsford, Esq., who, it is understood, are favourable to the measure.—Mr. Rendel concludes this division of his report, by giving a summary of comparison between the line surveyed through the South Hams, and that now proposed over Dartmoor.

| | |
|---|---|
| The length of the former is, say ..... | 50 miles. |
| The length of the latter is, say ..... | 43 miles. |
| Being less in length by ..... | 7 miles. |

The line over Dartmoor is calculated to cost about half the sum estimated for the line through the South Hams. The time required for completing the works, with the most economical despatch, would be five years; but the line and branch connecting Plymouth, &c., with Tavistock, could be opened in two years after the commencement of the works, so that an income would then begin.

Northern and Eastern Railway.—A farther portion of the Northern and Eastern Railway, five miles and a half, has been placed under contract, viz., from Broxbourne to Latton Mill, at about 20,000*l.*, to which are to be added 2500*l.* per mile for the land, and 4000*l.* for the rails, chairs, and sleepers, making the total cost of that length about 10,500*l.* per mile, and which will be opened for traffic in April or May next.

## MISCELLANEOUS.

Patent Wire Rope for Standing Rigging.—A series of trials of Smith's Patent Wire Rope has been made at the Corporation Testing-machine, in Trentham-street, Liverpool, in presence of a number of nautical gentlemen and others interested in improvements in navigation, and the result was highly satisfactory. The patent consists of improved methods of forming a rope from any number of wires that shall be flexible, is served with hemp, and can only be spliced or knotted. The rope is in the usual way, so as to exclude the water, and a chemical preparation is employed to prevent oxidation. The rigging with wire rope is smaller and lighter than of hempen rope, and, as it offers much less resistance to the wind, is of great advantage in beating to windward. The cost, too, is much less, and the durability greater. In the trials we have alluded to, the following results were ascertained:—

| | | | | | |
|---|---|---|---|---|---|
| 1-inch rope broke at ..... | 2 | tons | 1 | cwt. |
| 1¼ | .. | .. ..... | 5 | .. | 0 | .. |
| 2¾ | .. | .. ..... | 8 | .. | 14 | .. |

Other sized were also tried with proportionate success; and it should be remarked that a *three-inch* hempen rope, of the best quality, broke at 2 tons 1 cwt. The weight, or traction, borne by each piece of different sized rope far exceeded that fixed in the scale of the patentee—thus showing great superiority in the workmanship of the manufacturers, Messrs. Fox and Co., of London and Birmingham. According to the scale alluded to, the weight to be sustained by 1¼-inch wire rope is 3 tons 10 cwt. and so in proportion. Another good quality of the wire rope is the elasticity, which, though not of course equal to that of hempen rope, is quite sufficient to counteract the effects of a sudden jerk while a vessel is rolling heavily at sea. One comparatively short length of rope that was tried stretched 18½ inches before it broke; a very short length of 1¼-inch stretched six inches. The machine on which the tests were made is very ingenious, and of tremendous multiplying power; it is that on which iron cables for the largest ships are put to their utmost tension of many tons. Those present took a deep interest in the operations, and were at once gratified and astonished to witness the immense weight or traction sustained by lengths of wire rope so comparatively small and light. It should be added that this patent rigging has been tested at sea upwards of five years, and that amongst the ships fitted with it in our own port are those crack steamers the *Oriental* and the *Liverpool*. The new light ship, the *Albert*, destined for the Victoria Channel, is also rigged with it, and it has hitherto been highly approved by practical men.

Singular Electrical Phenomenon.—At the late annual meeting of the Royal Institution of Cornwall, Mr. Tweedy read some letters submitted to the institution by Mr. Robert Were Fox, which had been addressed to him on the subject of a recent discovery of the generation of electric power from steam-boilers. The letters were from T. Sopwith, Esq., and W. G. Armstrong, Esq., of Newcastle. The circumstance which first attracted attention was thus related:—A jet of steam accidentally issued from an aperture in the cement of chalk, oil, and tow, between the flange of the safety valve and boiler. The engineman being about to touch the valve handle, while his other hand was in the jet of steam, felt a strong shock, and a spark. This phenomenon the engineman also observed on applying his hand to any part of the boiler within his reach, while the other hand was held in the jet of steam. Subsequently, experiments were made scientifically by Mr. Armstrong, and electric sparks were produced, to the number of sixty or seventy in a minute, at the distance of a quarter of an inch; and when the brass knob of the apparatus employed was nearer to the boiler, the stream of electric light was continuous. It appeared that the electricity of the steam was positive; and it was farther remarked that the quantity of electricity derived from the jet increased and diminished with the pressure of the steam. The valve was loaded at the rate of 35 lbs. to the square inch. In nine out of ten boilers on which experiments have been tried, the presence of electricity has been detected, though varying in intensity. The water in the boiler where the phenomenon was first noticed was highly impregnated with mineral matter. It was pumped out of a colliery, and very rapidly formed a hard incrustation in the boiler. Similar electrical effects had, however, been produced from boilers filled with rain and river water.—Communication on this subject has been opened with Mr. Faraday, who takes much interest in the experiments that have been made.

Depth of the Ocean.—In the late voyage of discovery by the French ship, the *Venus*, the sea was attempted to be sounded by the lead and line in latitude 57 deg. south. and 85 deg. 7 min. west longitude from Paris, that is a few hundred miles to the east of Drake's Islands, south-west of Cape Horn, and at a depth of 4000 metres, or 4370 yards, or near two and a half miles, no bottom was found. The weather was serene, and perfectly favourable, and it is said that the hauling in of the lead took sixty sailors upwards of two hours. In another place in the Pacific Ocean, latitude 4 deg. 32 min. north, and longitude 136 deg. 56 min. west of Paris, no bottom was found at the depth of 3790 metres.

Naples, 28th July.—"A new grotto has been discovered in the southern side of the mountain Pausilippo. It appears to be of great depth; the mouth is 16 feet wide and 45 feet high, but is filled up to about three-fourths of its opening with earth, fine sand, and rubbish, The sides are partly formed of the native rock, and partly raised by the hand of man, and in places retain some traces of sculptural reticulated ornaments. At about 400 yards from the entrance are twelve colossal marble statues, buried to the shoulders in the accumulations of earth, and the heads so much mutilated that it is impossible to make out whom they represent. There have also been found some small Greek and Roman coins. The cave cannot be entered except when the wind blows from the sea, for at other times the air becomes so rarified that breathing is difficult, and sometimes the torches are extinguished. The minister of the interior intends to propose to the king to have the grotto cleaned and explored at the expense of the state. For several days past Vesuvius has thrown out an unusual volume of smoke, the outer crust of the great crater has become red, and on the southern side of the volcano, towards Pompeii, there are fissures through which the fire may be seen within half a foot of the surface. From the long crevices in the new crater, made by the last eruption, thick sulphurous vapours are constantly issuing, and prevent all approach."

Sheerness Dockyard.—The dockyard at Sheerness is built upon mud land reclaimed from the sea, with great labour and ingenuity. It stands at the north-western point of the isle, facing the water, between that and the town of Sheerness, at the confluence of the Medway and the West Swale with the Thames. The form of the dockyard resembles a triangle, having its base, which is next the water, perfect; but its two sides irregularly described. Its area is 59 acres, 1 rood, and 26 perches; and it is surrounded by a brick wall crowned with stone, about 24 feet high, except at the side which abuts on the water. The foundation for the several buildings in it was formed by driving

99,000 piles. This dockyard was originally intended for the reception and repairing of ships partially damaged, and for building frigates of small burden. It has been much improved since the year 1815, and contains three basins, the largest of which is on a scale of magnitude to admit men-of-war of the first rate, without previously landing their guns or stores, or any part of their equipment. This basin is 520 feet long, and 300 broad, with an entrance of 60 feet, and a sufficient depth to prevent the ships grounding. It will hold six first-class ships at one time. The middle basin is 250 feet by 200, having an entrance of 49 feet. The other, or northern basin, is 282 feet 6 inches, by 200 feet 6 inches, with an entrance of 102 feet. There are three dry docks, 248 feet long, 88 feet wide, and 30 feet deep, having entrances 57 feet wide. These compose what is called the southern basin. There is also a frigate dock, 207 feet in length, 75 feet in breadth, and 19 feet 9 inches in depth; the entrance of which is 57 feet in width.

Copper in India.—A large chain of rocks, lying some depth below the water, have been lately discovered on the coast of Chittagong, on the Bay of Bengal, which are thickly studded with a profusion of rock oysters of an extraordinary size. The fish, when exposed, for the most part assume a deep green hue, and have a disagreeable cupreous flavour denoting the presence of copper. From the above circumstance, there can exist little doubt that a lode of the latter metal lies concealed in the immediate vicinity, which, if opened, would most probably prove a lucrative source of profit to the mining adventurer who might feel disposed to work the same. About three years since, a small nullah, leading from the Sooboonruka river, a little below the Chokee of Dantoon, in Orissa, into the valleys of the Nilgherry mountains, was entered by a small party of enterprising adventurers. The water of this nullah was completely discoloured, being of a clear green shade, and tasted so strongly of copper that the source of the stream must have been intimately connected with some copper lode concealed in the hills. There is no doubt but that India would prove rich in copper ore, if a geological investigation of certain districts of the country were promoted by the Government, which has not yet been contemplated.

Improvement in Blasting Rocks.—Mr. Mayer, mining superintendent at Gengenback, in the Duchy of Baden, has discovered that colophonium (resin) mixed with gunpowder, in the proportion of one ounce to a pound, doubles the strength of the powder, so that, in blasting, one ounce may be used instead of two, and with greater effect. The gunpowder and resin should be intimatety blended. Mr. Mayer made this discovery accidentally from putting a piece of paper, on which there happened to be some sealing wax, into his gun, as wadding, when, on his firing the gun, the effect being as if he had used a double charge, he was knocked down by the recoil. This he imputed to the resin, which is a principal ingredient in sealing wax.

Napoleon's Funeral.—There are to be thirty-two statues placed on each side of the passage over the Esplanade of the Invalides, along which the remains of the Emperor Napoleon are to be drawn to their tomb. With their pedestals they will be about 23 feet high. Among the kings and generals they are to represent are the following, in the order in which they will be arranged:—On the right, leaving the Invalides, Clovis, Charles Martel, Philip Augustus, Charles V., Joan of Arc, Louis XII., Bayard, Louis XIV., Turenne, Dugnay Trouin, Honche, Latour d'Auvergne, Kellermann, Ney, Jourdan, and Lobau. On the left, will be Charlemagne, Hugh Capet, Louis IX., Charles VII., Dagueselin, Francis I., Henry IV., Condé, Vauban, Marceau, Desaix, Kleber, Lannes, Massena, Mortier, and M'Donald.— *Galignani.*

Effective Power of the Cornish Steam-Engine.—The principle of expansion is not new; it is the extent to which it has been carried, especially of late years, by the successful adaptation of steam at a higher temperature than is used in the common condensing engine, which is new. The late Mr. Watt took out a patent in 1782 for working steam expansively, and in his specification, dated March 12, 1782, he says, "My new improvement in steam or fire engines consists in admitting steam into the cylinder of the engines only during some certain part or portion of the descent or ascent of the piston, and using the elastic forces wherewith the said steam expands itself in proceeding to occupy larger spaces as the acting powers on the piston, through the other parts or portions of the length of the stroke of the piston. He then shows that, if steam of 14 lb. pressure is admitted into a cylinder, and cut off at one-fourth of the length of the stroke, at half the stroke the pressure was reduced to 7 lb.; at three-fourths of the stroke to 4½ lb; and at the end of the stroke the steam would be reduced to 3½ lb., or one-fourth of its original power. The sum of all these powers is greater than 57-hundredth parts of the original power multiplied by the length of the stroke, and, consequently, that one-fourth the steam thus used produces more than half the effect that four times the quantity would have produced if worked dense through the whole stroke; consequently, the said new or expansive engine is capable of easily raising columns of water, whose weights are equal to 5 lb. on every square inch of the area of its piston, by the expenditure of only one-fourth the contents of the cylinder of steam at each stroke. The engine working dense steam might be loaded to 10 lb. per square inch of the area of the piston; and though, for example, I have mentioned the admission of one-fourth to the cylinders full of steam, as being the most convenient, yet any other proportion of the content of the cylinder will produce similar effects, and in practice I actually do vary the proportions as the case requires."

Railroad from Alexandria to Suez.—Dr. Bowring, in his recent official report on Egypt, makes some very judicious observations on the advantages that must attend the establishment of a railroad from Alexandria to Suez; "as to the accomplishment of which (remarks the learned doctor) within a moderate period, there can be as little doubt as of its practicability." The first steam-vessel which made its way from Suez to India decided the problem at once, leaving the question of time the only point unascertained. Europeans will not long be content to go thousands of miles out of their way round the Cape of Good Hope, now that they have found that they may as well step, as it were, out of the Mediterranean into the Red Sea; nor will they be content to crawl by the Nile and the Mahmoodieh Canal from Alexandria to Cairo, and to creep upon camels from Cairo to Suez, now that they know that a railroad would take them the whole overland journey between sun-rise and sun-set. Until Mehemet Ali cut the Mahmoodieh Canal, the voyage for goods from Alexandria to Cairo frequently occupied fifty or sixty days. Even now it occupies four days, the distance, in a straight line, not being more than 100 miles. Across the desert, from Cairo to Suez, the distance is only 80 miles, and, with the exception of a few miles of sand at each extremity, the road presents a level stony surface, more inviting for a railroad than any line of the same length we have ever heard of. According to an estimate some time since made for the pacha, the expense between Cairo and Suez would not exceed £680 per mile for rails, and the like sum for laying down, or to a little more than £100,000 on the whole. With such immense advantages to be derived from a railroad, with such facilities for its construction, and with the ardent desire of the pacha for its completion, there can be little doubt that our Indian Steam Navigation Company would soon enable him to accomplish this portion of the line, as they have at present to transport all their coal from Cairo on camels. But the whole line from Alexandria ought to be undertaken as a great European work, and to be placed by treaty under European protection. In the negociations which are likely to ensue, the five great powers, while remodelling the relations between Turkey and Egypt, will have the power of stipulating for a high road from the Mediterranean to the Red Sea, and for taking the conservation of it into their own hands; and the common interest of the whole European family should induce them to do so, not merely as a matter of common convenience, but as the means of preventing future jealousies, intrigues, and perhaps hostile collisions. If they do not do it now as a body, they will soon be aiming at it as rivals. So forcibly do we feel the importance, not only of the work being performed, but of its security, under any future disturbances, being provided for, that with a view to it alone we think that the European powers, when they guarantee Egypt to Mehemet Ali and his heirs in perpetuity, ought to guarantee, also, its permanent neutrality.—*Mining Journal.*

---

## LIST OF PATENTS.

*Continued from page* 240.

(SIX MONTHS FOR ENROLMENT.)

John Duncan, of Great George-street, Westminster, gentleman, for "improvements in machinery for cutting, reaping, or sowing, grass, grain, corn, or other like growing plants or herbs," being a communication.—Sealed November 2.

Elijah Galloway, of Manchester-street, engineer, for "improvements in propelling railroad carriages."—Sealed November 2.

Josiah Pumphrey, of New Town-row, Birmingham, brass-founder, for "certain improvements in machinery to be employed in the manufacture of wire hooks and eyes."—Sealed November 2.

Henry Wimshurst, of Limehouse, ship-builder, for "improvements in steam vessels in communicating power to propellers of steam-vessels, and in shipping and unshipping propellers."—Sealed November 2.

James Heywood Whitehead, of Royal George Mills, York, manufacturer, for "improvements in the manufacture of woollen belts, bands, or driving straps."—Sealed November 2.

James Boydell, jun., of Cheltenham, for "improvements in working railway and other carriages in order to stop them, and also to prevent their running off the rails."—Sealed November 2.

John Edward Nange, of Lincoln's Inn Old Square, captain in the 81st regiment, for "improvements in apparatus for serving ropes and cables with yarn."—Sealed November 2.

Herman Schroeder, of Surrey Cottage, Peckham, broker, for "improvements in filters," being a communication.—Sealed November 2.

John Wordsworth Robson, of Wellclose-square, artist, for "certain improvement or improvements in water closets."—Sealed November 2.

Richard Farger Emmerson, of Walworth, gentleman, for "improvements in applying a coating to the surfaces of iron pipes and tubes."—Sealed November 3.

John Rapson, of Limehouse, millwright, for "improvements in paddle wheels for propelling vessels by steam or other power."—Sealed November 3.

Henry Hina Edwards, of Nottingham-terrace, New-road, engineer, for "improvements in evaporation."—Sealed November 5.

Pierre Matthew Mannonry, of Leicester-square, gentleman, for "improvements in wind and stringed musical instruments," being a communication.—Sealed November 5.

George Groynne, of Duke-street, Manchester-square, gentleman, for "improvements in the manufacture of candles, and in operating on oils and fats."—Sealed November 5.

George Dacres Paterson, of Truro, esq., for "improvements in curvilinear turning, (that is to say) a rest adapted for cutting out wooden bowls, and a self-acting slide rest for other kinds of curvilinear turning."—Sealed November 5.

Henry Kirk, of Blackheath, gentleman, for "improvements in the application of a substance or composition as a substitute for ice for skating and sliding purposes."—Sealed November 5.

Charles Joseph Hullmandel, of Great Marlborough-street, lithographic printer, for "a new effect of light and shadow, imitating a brush or stump drawing, or both combined, produced on paper, being an impression from a plate or stone, prepared in a particular manner for that purpose; as also the mode of preparing the said plate or stone for that object," four months.—Sealed November 5.

John Clarke, of Islington, Lancaster, plumber and glazier, for "an hydraulic double-action force and lift pump," being a communication.—Sealed November 5.

George Delainson Clark, of the Strand, gentleman, for "an improvement in purifying tallow fats, and oils, for various uses, by purifying them, and depriving them of offensive smell; and by solidifying such as are fluid, and giving additional hardness and solidity to such as are solid; and also by a new process of separating stearine or stearic acid from the elaine in such substances," being a communication.—Sealed November 5.

Alexander Horatio Simpson, of New Palace-yard, Westminster, gentleman, for "a machine or apparatus to be used as a moveable observatory or telegraph; and as a moveable platform, in erecting, repairing, painting or cleaning, the interior and exterior of buildings; and also as a fire escape," being a communication.—Sealed November 5.

Andrew Kurtz, of Liverpool, manufacturing chemist, for "a certain improvement, or certain improvements in the constructions of furnaces."—Sealed November 5.

George Halpin, jun., of Dublin, civil engineer, for "improvements in applying air to lamps."—Sealed November 7.

William Crofts, of New Radford, Nottingham, machine maker, for "certain improvements in machinery, for the purpose of making figured or ornamental bobbin net or twist lace, and other ornamental fabrics looped or woven."—Sealed November 7.

Charles de Bergue, of Blackheath, gentleman, for "improvements in machinery for making reeds used in weaving," being a communication.—Sealed November 7.

Edward Dodd, of Kentish Town, musical instrument maker, for "improvements in piano-fortes."—Sealed in November 7.

George Edmund Donisthorpe, of Leicester, machine maker, for "certain improvements in machinery or apparatus for combing and preparing wool and other textile substances."—Sealed November 7.

John Joseph Mechi, of Leadenhall-street, cutler, for "improvements in apparatus to be applied to lamps in order to carry off heat, and the products of combustion," two months.—Sealed November 10.

Thomas Lawes, of Canal Bridge, Old Kent Road, feather factor, for "certain improvements in the method or process and apparatus for cleansing and dressing feathers."—Sealed November 10.

William Mc'Kinley, of Manchester, engraver, for "certain improvements in machinery or apparatus for measuring, folding, plaiting, or lapping goods or fabrics."—Sealed November 10.

Charles Edwards Amos, of Great Guildford-street, Borough, millwright, for "certain improvements in the manufacture of paper."—Sealed November 10.

Thomas William Parkin and Elisha Wilde, of Portland-street, Liverpool, for "an improved method of making and working locomotive and other steam-engines," two months.—Sealed November 12.

Eugenius Birch, of Cannon-row, Westminster, civil engineer, for "improvements applicable to railroads, and to the engines and carriages to be worked thereon."—Sealed November 12.

John Heaton, of Preston, overlooker, for "improvements in dressing yarns of linen or cotton, or both, to be woven into various sorts of cloth."—Sealed November 12.

Otto C. Von Almonde, of Threadneedle-street, merchant, for "improvements in the production of mosaic work from wood, being a communication."—Sealed November 12.

Charles Dod, of Buckingham-street, Adelphi, gentleman, for "certain methods or processes for the manufacture of plate glass, and also of substances in imitation of marble stones, agates, and other minerals, of all forms and dimensions, applicable to objects both of use and ornament," being a communication, four months.—Sealed November 12.

Charles Wye Williams, of Liverpool, civil engineer, for "certain improvements in the construction of furnaces and boilers."—Sealed November 17.

Joshua Shaw, of Goswell-street-road, artist, for "certain improvements in discharging ordnance muskets, fowling pieces, and other firearms."—Sealed November 17.

Joseph Whitworth, of Manchester, engineer, and John Spear, of the same place, gentleman, for "certain improvements in machinery, tools, or apparatus, for cutting and sharpening metals, and other substances."—Sealed November 17.

James Deacon, of Saint John-street-road, gentleman, for "improvements in the manufacture of glass chimneys for lamps."—Sealed November 19.

Alexander Stevens, of Manchester, engineer, for "certain improvements in machinery or apparatus to be used as an universal chuck for turning and boring purposes, which said improvements are also applicable to other useful purposes."—Sealed November 19.

William Henson, of Allen-street, Lambeth, engineer, for "improvements in machinery for making or producing certain fabrics with threads or yarns applicable to various useful purposes."—Sealed November 19.

John Cox, of Ironmonger-lane, civil engineer, for "certain improvements in the construction of ovens applicable to the manufacture of coke, and other purposes," two months.—Sealed November 21.

John Wakefield, of Salford, hat manufacturer, and John Ashton, of Manchester, hat manufacturer, for "certain improvements in the manufacture of hat bodies."—Sealed November 21.

William Henry Hutchins, of Whitechapel-road, gentleman, and Joseph Bakewell, of Brixton, civil engineer, for "improvements in preventing ships and other vessels from foundering and also for raising vessels when sunk."—Sealed November 21.

Francis Pope, of Wolverhampton, engineer, for "improvements in detaching locomotive and other carriages."—Sealed November 24.

John Haughton, of Liverpool, clerk, M.A., for "improvements in the means employed in preventing railway accidents resulting from one train overtaking another."—Sealed November 24.

Henry Charles Danberry, residing at Boulogne, esq., for "improvement in the making and forming of paddle-wheels for the use of vessels propelled on the water, by steam and other power, and applicable to propel vessels and mills."—Sealed November 25.

Thomas Barratt, of Somerset, for "improvements in the manufacture of paper."—Sealed November 25.

Junius Smith, of Fen-court, Fenchurch-street, esq., for "certain improvements in furnaces," being a communication.—Sealed November 25.

Charles Grellett, of Hatton-garden, for "new modes of treating potatoes, in order to their being converted into various articles of food, and new apparatus for drying, applicable to that and other purposes," being a communication.—Sealed November 25

William Henry Bailey Webster, of Ipswich, surgeon, for "improvements in preparing skins and other animal matters for the purpose of tanning, and in the manufacture of gelatine."—Sealed November 25.

Oliver Louis Reynolds, of King-street, Cheapside, merchant, for "certain improvements in machinery, for producing stocking, fabric, or framework-knitting," being a communication.—Sealed November 25.

Nathaniel Baths, of Manchester, engineer, for "certain improvements in machinery tools, or apparatus for planing, turning, boring or cutting metals and other substances."—Sealed November 25.

Frederick Theodore Phillipi, of Bellfield-hall, calico printer, for "certain improvements in the art of printing cotton, silk, and other woven fabrics."—Sealed November 25.

James Lee Hannah, of Brighton, doctor of medicine, for "an improvement or improvements in fire escapes."—Sealed November 25.

Robert Roberts, of Bradford, blacksmith, for "a new method or process for case-hardening iron."—Sealed November 25.

Henry Walker Wood, of Chester-square, gentleman, for "an improvement in producing an uneven surface in wood and other substances," being a communication.—Sealed November 25.

FIG. 1.

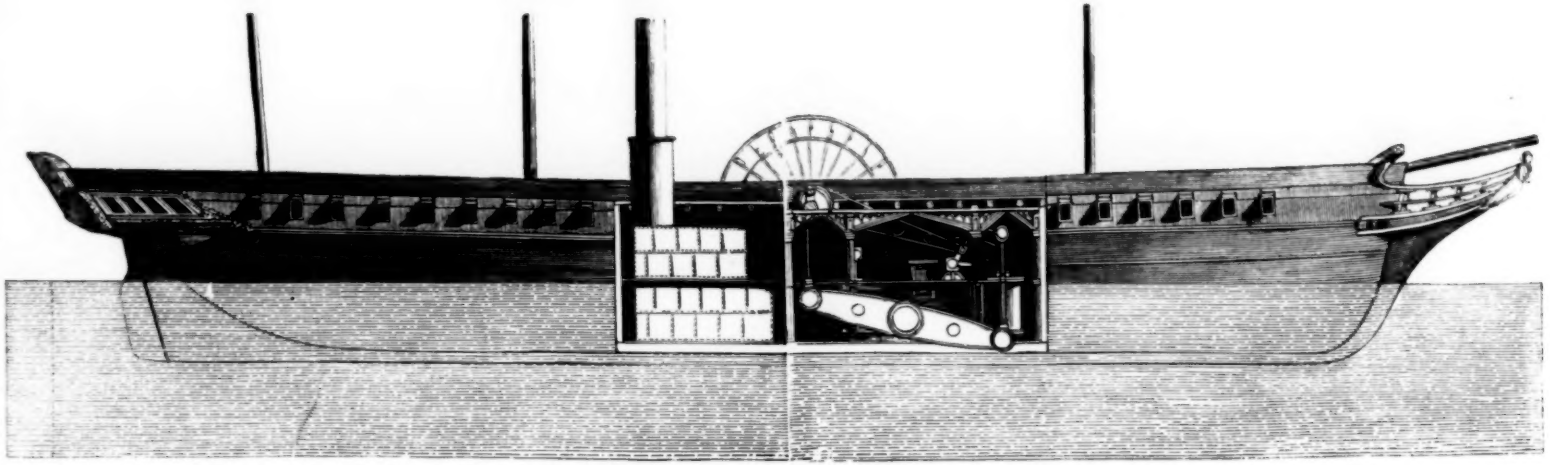


FIG. 2.

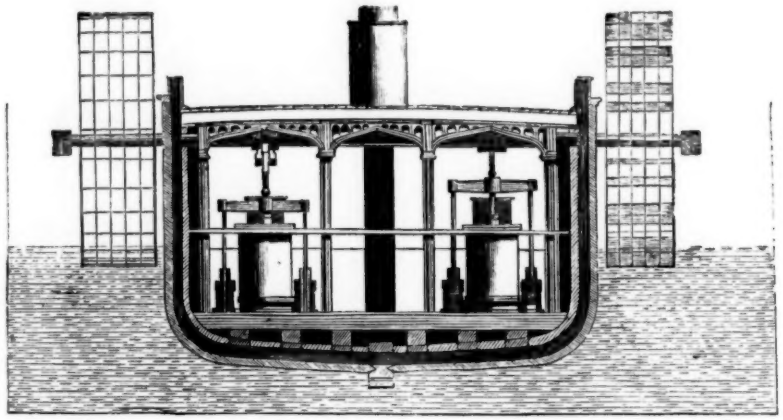


FIG. 3.

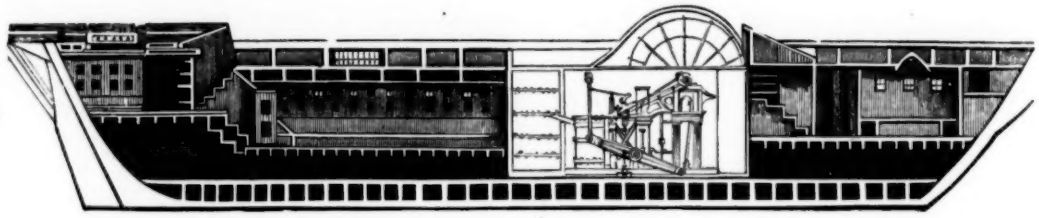


*Fig.* 1.—*Section of the British Queen Steamer from stem to stern, length* 275 *feet.*

*Fig.* 2.—*Section of ditto midship, showing paddle-wheels, breadth* 64 *feet.*

*Fig.* 3.—*Section of a common steam boat from stem to stern.*